



**Hilcorp Alaska, LLC**

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March 29, 2017

Geoff Merrell  
State On-Scene Coordinator  
Alaska Department of Environmental Conservation  
555 Cordova Street  
Anchorage, AK 99501

Re: Middle Ground Shoal Platform, Natural Gas Pipeline Release  
Middle Ground Shoal Gas Leak Sampling and Monitoring Plan Summary Report  
Sampling Period #2 ending 03/28/2017

Dear Mr. Merrell:

Hilcorp Alaska, LLC ("Hilcorp") submitted the Middle Ground Shoal Gas Leak Sampling and Monitoring Plan ("Plan") to the Department of Environmental Conservation ("Department") on March 8, 2017. Preliminary approval to implement the Plan was provided by the Department on March 10, 2017. As described in Section 3.2 of the Plan, Hilcorp is submitting this second weekly summary report to the Department.

In an effort to provide data to the Department as quickly as possible, a complete and thorough quality control evaluation has not been completed at this time. Please note that all data presented in this report is preliminary and should be considered as such until a quality control evaluation is completed. Hilcorp will continue to evaluate data quality and will notify the Department of any significant issues as soon as possible.

#### **Ice Monitoring:**

Hilcorp continues to monitor ice conditions in the area of the gas leak using helicopter overflights and platform observations. Observations are compared to the National Oceanic and Atmospheric Administration (NOAA) ice forecasts. Ice conditions are monitored daily as conditions allow and updates are provided to the Department via Situation Reports. Hilcorp anticipates ice conditions to continue to improve with forecasted warmer weather conditions.

#### **Fish and Wildlife Monitoring:**

On March 22, one CISPRI protected species observer and one wildlife observer professional from International Bird Rescue conducted an extended overflight of approximately 20 square miles surrounding the gas leak location (within a 5-mile diameter circle). The helicopter pilot dictated a minimum altitude of approximately 500 feet. To avoid incidental harassment of marine mammals, altitude would have been

increased to 1500 feet, but only in the case where marine mammals were actually spotted. Flight conditions and visibility were very good. No marine mammals, birds, or fishes were observed within the 20 square mile area. Wildlife observer reports are provided in Attachment A.

The next fish and wildlife monitoring events are planned for today (March 29) and Friday (March 31), 2017. Overflight dates for April are currently being scheduled. Wildlife monitoring will continue for two weeks after completion of the temporary pipeline repair.

### **Water Quality Sampling:**

#### *Sampling Period # 1 ending 3/21/2017*

As indicated in the previous report, water quality data had not been fully reviewed, analyzed, and compiled for reporting. As we continue to evaluate the data we have identified an error in the report submitted to the Department on March 22, 2017. As further described in Attachment B, raw data obtained from the dissolved oxygen probe used on March 18 and 19, 2017 at 12.5 meters below the water surface required reprocessing following re-calibration of the sensor. The reprocessed data indicates the lowest dissolved oxygen reading from Drift #3 on March 19, 2017 was 10.0 mg/L, not 7.8 mg/L as previously reported. We continue to quality control the data and will provide updates to the Department as significant issues are identified.

Water quality laboratory results from Sampling Period #1 were received and tended to be similar for CO<sub>2</sub> and slightly lower for methane than in-situ measurements. Variations may be the result of the collection methods, analysis method, and variability in collection time and location. Additional information is provided in Attachment B.

#### *Sampling Period # 2 ending 3/28/2017*

The water quality buoy was successfully deployed four times in the area of the gas leak on March 23, 2017. The buoy was equipped with sensors to monitor temperature, pH, salinity, ORP, conductivity, relative conductivity, and concentrations of dissolved oxygen and methane at depths of 2, 7 and 12.5 meters below the water surface.

Due to the short period between the monitoring event and this preliminary report, all of the data collected has not been fully reviewed, analyzed, and compiled for reporting. Data analysis for Week #2 focused on Drifts #2 and #4 which came within 3.3 meters and 2.9 meters from the gas release, respectively. Although data analysis for this week has focused on these two drifts, a thorough quality control evaluation has not been completed at this time.

Water quality sampling showed limited variability in dissolved oxygen concentrations with the lowest dissolved oxygen reading well above the water quality standard specified under 18 AAC 70 for marine waters. A transient increase in dissolved methane concentrations up to 28.7 mg/L was observed 750 meters into Drift #4; however a second drift located just 0.4 meters to the east showed maximum dissolved methane concentration of 0.6 mg/L. The aggregated data suggest that the higher methane reading, is localized and the methane dissipates quickly.

The highest methane concentration observed (28.7 mg/L) was coupled with a dissolved oxygen concentration of 11.58 mg/L. For reference, the State's most protective water quality standard for dissolved oxygen is 6 mg/L. No violations of state water quality standards were identified.

A summary report and additional safety documentation for the water quality sampling efforts are provided in Attachment B. The next water quality sampling effort is planned to occur today (March 29), conditions permitting.

### **Air/Water Interface Sampling:**

Air/Water Interface Sampling was conducted on Friday, March 24, 2017, and Sunday, March 26, 2017. The air/water interface buoy was equipped with sensors to monitor concentrations of methane, carbon dioxide, and oxygen at the air/water interface. The air/water interface buoy was also equipped with sensors to monitor dissolved methane, temperature, conductivity, dissolved oxygen, and salinity in water at a depth of 1.5 to 1.75 meters below the water surface.

Five drifts were completed on March 24, 2017. GPS coordinates indicate the buoy traversed as close as 15 meters from the reported leak coordinates however, methane was not detected in the air at the air/water interface during any of the deployments. To verify the sensors were working correctly, equipment specialists conducted several tests and modified the equipment to remove splash guards on Saturday, March 25, 2017. The air/water interface buoy was redeployed on Sunday, March 26, 2017 and traversed within 100 meters from the reported leak coordinates. Again, methane was not detected in the air at the air/water interface. The methane sensor used during both deployments has a lower detection limit of 10,000 ppm which has previously been identified as having no toxic effects in mammals.<sup>1</sup>

A summary report and additional safety documentation for the water quality sampling efforts are provided in Attachment B. To further evaluate the potential concentrations of methane at the air/water interface, Hilcorp procured an additional methane sensor capable of quantifying methane concentrations as low as 250 ppm. The new sensor arrived in Nikiski, Alaska on March 28, 2017 and is scheduled for use during the next air/water interface sampling effort today (March 29), conditions permitting.

### **Acoustic Monitoring:**

Acoustic monitoring was conducted on Sunday March, 27, 2017. An Autonomous Multichannel Acoustic Recorder (AMAR) was deployed to collect acoustic recordings. The sound recorder was successfully deployed 4 times and drifted as close as <20 meters to the leak site to collect sound levels emitted by the leak and up to 2.4 kilometers to collect background sound levels. During the final deployment, the buoy was entrapped in ice resulting in lost communication with the GPS/satellite beacon. Several hours were spent attempting to find and retrieve the recorder. The satellite beacon resumed transmission Monday morning and the work boat was deployed for a successful recovery of the buoy. A summary of the acoustic monitoring activities is provided in Attachment C. Acoustic data obtained from the buoy, which are

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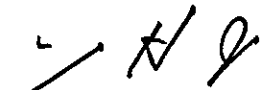
<sup>1</sup> Animals exposed to methane at 10,000 ppm showed no toxic effects, and there is no potential for systemic toxicity in mammals [NRC (National Research Council). 1984. a. Emergency and Continuous Exposure Limits for Selected Airborne Contaminants, Vol. 1. Washington, DC: National Academy Press].

recorded by the AMAR as wave files, is currently being downloaded and converted to a format usable to evaluate sound levels. Preliminary sound level data is expected to be reported on April 5, 2017.

Three four-gas meters were used to monitor air conditions continuously to establish a safe work zone during all vessel-based sampling efforts. Lower Explosive Limit (LEL) readings from the meters did not exceed 0%.

If you have any questions or concerns regarding this letter, please feel free to contact either myself or the appropriate Hilcorp staff member as we continue to work with you on our ongoing response to this event.

Sincerely,

A handwritten signature in black ink, appearing to read 'W. G. Britt, Jr.', with a stylized flourish at the end.

William G. Britt, Jr.  
Environmental Manager

Attachments:

Attachment A: Fish and Wildlife Monitoring Summary Report

Attachment B: Water Quality Sampling and Air/Water Interface Sampling Summary Report

Attachment C: Acoustic Monitoring Summary Report

**ATTACHMENT A**  
**FISH AND WILDLIFE MONITORING SUMMARY REPORT**

## Hilcorp Cook Inlet Wildlife Survey Narrative

## March 22, 2017 Report

**By Wildlife Observer** **r, IBR**

I arrived at Ross Aviation at 8:45 am, and took Hilcorp charter from Anchorage to Kenai, landing in Kenai about 9:30 am. I picked up a Hilcorp pool car at the Kenai hangar.

I ate breakfast and arrived at OSK helipad at noon. Met Wes Clark from CISPRI who I was the marine mammal observer on the same flight. We were able to talk to Joe the pilot briefly before the flight and agreed on 500' altitude and speed of about 85 knots in concentric circles around the leak site up to a radius of 5 miles from leak.

We started the survey on the Bell 212 helicopter at 1:05 pm (see data form, GPS map, and photos on email). Wes sat at the inside circling window and I sat at the outside circling window (counterclockwise circles). The weather was ideal with clear visibility, low wind, and calm seas. We were able to fly the entire survey around the leak site at 500 feet altitude, but no wildlife was spotted. [NOTE: I am looking for movement – e.g., flight or dive rings. It is impossible to spot a motionless (e.g., dead) bird from that altitude and ice pattern].

There was between 25-50% open water overall in the survey area, and about 20% open water over the leak site. Wes reported seeing a swell-type movement under the ice near the leak at the end of the survey.

We finished the survey at 1400 and I checked the Nikiski weather station data. I received a map of the GPS waypoints from Wes Clark (CISPRI) via email that afternoon. Before returning to the Kenai hangar, I checked three coastal sites for marine birds:

1. Captain Cook State Park near Discovery Campground @1515 outgoing tide 0 marine birds seen
2. Nikishka Beach Road dock area @1545 outgoing tide 3 Herring Gulls
3. End of Salamatof Road near dock @ 1605 outgoing tide 0 marine birds seen

I worked on today's report while waiting for the Otter flight back from Kenai to Anchorage. I arrived at Ross Aviation hangar in Anchorage about 6:20 pm.

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## Cook Inlet Hillcorp Pipeline Surveys

	Date	Bird Obs	Start Time	End Time	Slack Tide Time	Tide Loc	Approx Survey Speed (kts)	Approx Survey Alt (ft)	Approx Area Obs (sq mi)	% Open Water	Beaufort Sea State	Swell	Nikiski Weather Time	Air Temp (deg F)	Wind Speed (kts)	Wind Dir	Visib (mi)	Cloud Cover (%)	Precip (in)	Pilot	Marine Mammal Obs	Comments
1	3/9/2017	flight data sheet not completed for March 9, 2017																				
2	3/17/2017	WO	1505	1550	1513	Nik	85	500	15	<25	0	0	1415	18.5	6.8	ENE	100+	0	0	TP	PSO	No wildlife observed
3	3/20/2017	WO	1010	1120	1028	Nik	85	500	20	<25	0	0	1135	26.4	4.3	NNW	100+	5	0	unk	PSO	No wildlife observed
4	3/22/2017	WO	1305	1400	1311	Nik	85	500	20	25-50	0	0	1413	31.3	2.5	ESE	100+	0	0	Joe	PSO	No wildlife observed. Approx. 20% open water around leak site. Slight swell seen under ice near leak per PSO
5																						
WO - Wildlife Observer																						
PSO - Protected Species Observer																						

## Cook Inlet Operations - Protected Species Observer Effort Log

Project ID: PSO

**Name:** Protected Species Observer

Initial: PSO

**Vessel Name:**

Hilcorp Helo

Protected Species Observer

PSO

**Effort Log Page #:**

MMO-007

[illegible]



12/2016

3rd Point

2nd POINT

START 22MAR

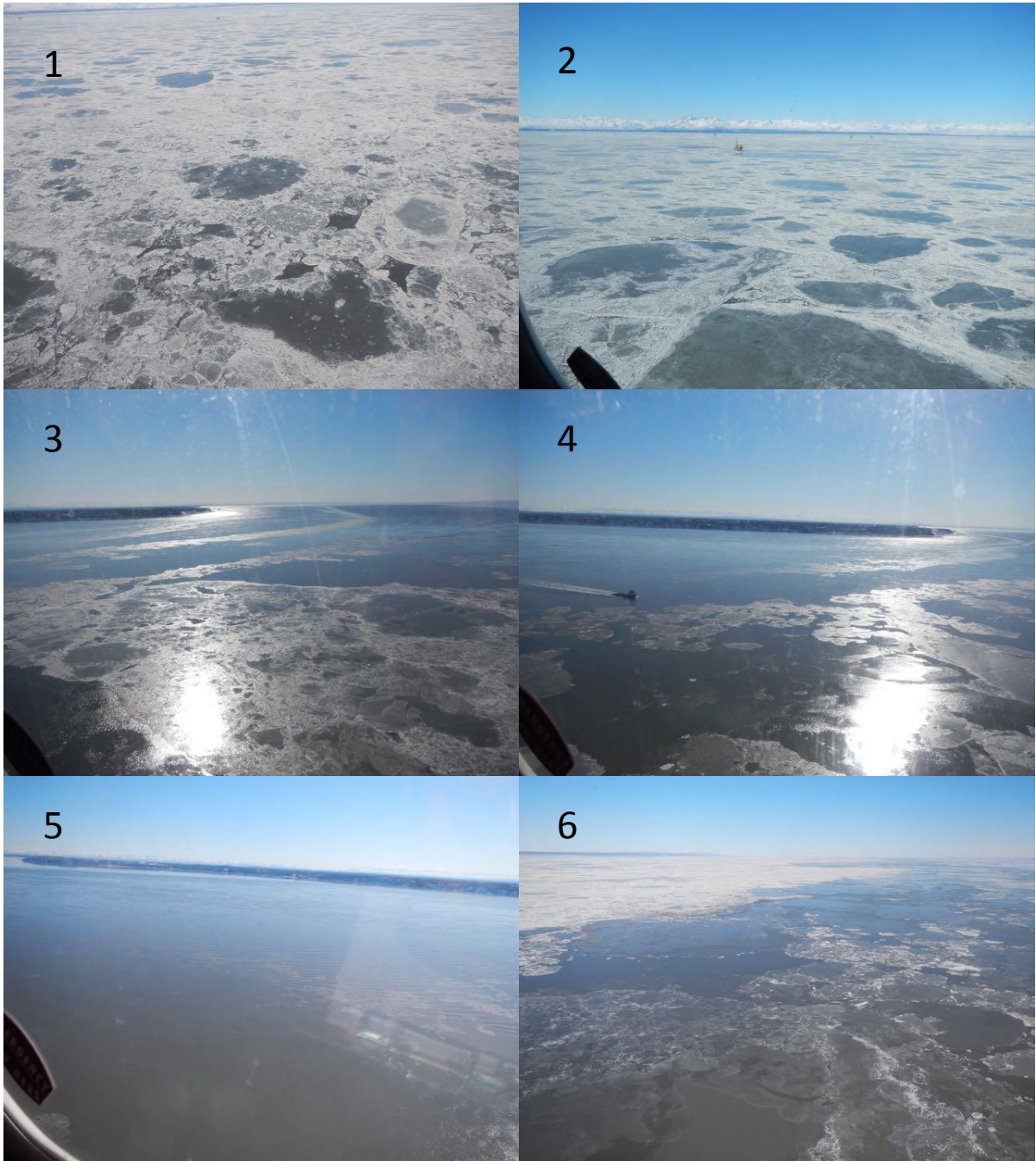
Final POINT

Image Landsat / Copernicus

Nikiski

Go

Imagery Date: 12/30/2016 60° 46.336' N 151° 23.124' W elev -64 ft



Photos were taken in counterclockwise progression of the first circle around the leak, starting NNW. Flight circles are approximately 0.5 miles apart. Photo 2 includes a view of Platform A. The still water has been conducive to detecting flight or dive movements of wildlife.

**ATTACHMENT B**

**WATER QUALITY AND AIR/WATER INTERFACE SAMPLING SUMMARY REPORT**

# Cook Inlet Methane Pipeline Leak Area

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Water Quality and Air/Water Interface Monitoring

## Weekly Report #2

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Prepared by SLR International Corporation (SLR)

Report Date: 3-29-2017

### 1.0 OVERVIEW

The second water quality monitoring event and first air/water interface sampling were conducted from aboard the Offshore Service Vessel (OSV) Resolution during this reporting period using the approaches and methods described in the ADEC-approved plans (SLR 2017a and b). Safety of the vessel and crew was top priority during the monitoring activities. Work was performed during daylight hours and the sampling approaches allowed for the collection of data, while maintaining a safe distance from the methane release point (MRP). For health and safety, air monitoring was performed for potential explosive vapors on board the vessel by a dedicated safety professional. The quantity and location of sampling events were determined by site and weather conditions. The data presented herein is preliminary, subject to further review and verification by SLR International Corporation (SLR).

For the purposes of monitoring reporting a revised location provided by Hilcorp was used for location of the methane leak. The revised location and depth is:

- Latitude 151°26'01.84"W, Longitude 60°46'35.68"N
- Easting 1384137.82, Northing: 2478537.39
- Water Depth (MLLW) = 21.18 meters (69.51 feet)

This location is referred to as the Methane Release Point (MRP). Initial estimates of the leak rate ranged from 203 to 300 thousand cubic feet per day (MCFD). On March 13, Hilcorp reduced the pressure in the line and reported the gas flow rate from the leak was 193 to 215 MCFD. On March 25, 2017, the leak rate was further reduced to 85 to 115 MCFD.

As discussed in Section 2.2 of this report, based on the preliminary data review completed to date, the dissolved oxygen (DO) concentrations measured during this event and the previous event did not exceed the Alaska Water Quality Standards (AWQS) as established in Title 18 Alaska Administrative Code (AAC), Chapter 75 (18 AAC 70).



## 2.0 WATER QUALITY MONITORING

### 2.1 Activities Completed

Water quality monitoring and sampling was conducted on March 23, 2017. The monitoring period covered portions of a flood and ebb tide, including the transitional slack period. The field team consisted of two SLR and two Kinnetic Laboratories, Inc. (KLI) scientists. The field team members (samplers) were Alaska Department of Environmental Conservation (ADEC) qualified samplers, per 18 Alaska Administrative Code 75.

The data collection activities followed the Water Quality Cook Inlet Alaska Methane Pipeline Leak Water Quality Sampling Plan (WQ Plan), (SLR 2017a). The primary data collection method utilized a drifting instrumented buoy to obtain water quality parameters in the area of interest. The drifting buoy had multiple instruments suspended along a line at three depth intervals (2, 7 and 12.5 meters) as depicted on Figure 1. The primary instruments are listed below:

- SeaBird Electronics, SBE 19 plus V2 SeaCAT- conductivity, depth, temperature (CTD), with dissolved oxygen (DO), pH, and turbidity.
- Pro-Oceanus Mini Methane
- Pro-Oceanus Mini Carbon Dioxide
- PME MiniDOT
- Garmin WAAS differential global positioning system (mounted on buoy and used to track the buoy's position during a monitoring transect)

Reported instrument depths below the water surface (bws) are based on length of line from the bottom of the buoy to the instrument(s). The buoy drifted with the current so the instrument string maintained a near vertical position during deployment. This was verified by review of the depth reading obtained by the CTD, which was located at the end of the line. The recorded CTD depths were 12.5m  $\pm$  0.1m. A summary of the parameters measured by each instrument and frequency is provided in Attachment A, Table A-1.

Some modifications to the sampling methods outlined in the WQ Plan were made due to site conditions.

- Ice conditions during the second event varied from approximately 0-4 tenths ice cover during the beginning and end of the flood tide to 9-10 tenths cover during the mid-part of the flood tide (around 1-2pm AKST). The heavier ice during the latter part of the mid-part of the flood impeded the deployment of the instrumented drift buoy. Sampling and monitoring activities were responsive to these dynamic site conditions.
- Air temperatures varied between -3 and -15 °C with water temperatures typically about -1.5 °C, and icing of equipment was a concern. Due to the cold air temperatures, instrumentation occasionally iced up from the slush and frazil ice at the sea surface. The field team frequently removed ice from equipment between deployments.

- On the first two drifts, a backup DO probe was utilized on SeaBird CTD system, as opposed to the original one used the prior week. However, the backup DO probe failed to function (due to a faulty membrane). As a contingency and check a miniDOT sensor was placed on the SeaBird CTD cage, so DO data was still collected on those drifts. On the subsequent two drifts, the original DO probe was utilized.

Four buoy drifts (monitoring transects) were completed through the area surrounding the MRP on March 23 at differing tidal stages. At the MRP site, the tide changes about 50 minutes after NOAA tidal predictions for the East Forelands area, and drifts were planned accordingly. The duration of each drift varied from approximately 23 to 57 minutes, depending upon the tidal flow. Plots of the drifts are illustrated in Figure A-2. During Drift #4 the field team observed bubbles at the surface near the reported MRP location (see Photograph Log). Table A-2 provides a summary of the buoy deployments and indicates the closest distance from the MRP for each drift. Drifts #4 and #2 passed at 2.6 meters and 3.3 meters from the MRP, respectively while Drifts #1 and #3 were 71 and 166 meters from the MRP, respectively.

In addition, water samples for laboratory analysis were collected down current of the MRP at several depths (surface, middle and deep) using Niskin bottles at two sampling stations. The locations were closer to the MRP than those collected the prior week, at an estimated distance of distance of 177 and 257 meters. The sampling locations are shown on Figure A-2. A total of five primary samples, plus one sample duplicate were collected and sent to the analytical laboratory (ALS Environmental in Simi Valley, California) for analysis of CH<sub>4</sub> and CO<sub>2</sub>. Results are anticipated on March 31, and will be documented in a subsequent report.

A photograph log documenting the data collection methods and site conditions during week 2 is included in Attachment A.

## 2.2 Summary of Results

### ***Buoy Transects-Week 2***

This weekly report provides summary results for the two drifts on March 23, 2017 that came closest to the MRP: Drift #2 on the flood tide which passed 3.3 meters from the MRP and Drift #4 on the ebb tide which passed 2.6 meters from the MRP. During both drifts the WQ Buoy was deployed up current of the MRP and retrieved on the down current side. Due to the short period between the monitoring event and the reporting date, all of the data collected during the second sampling event has not been fully reviewed, analyzed and compiled for reporting. This includes Drift #1 and Drift #3.

A summary of the dissolved oxygen and dissolved methane results from the Drifts #2 and #4 from March 23, 2017 is provided below.

- Dissolved oxygen- Review of the data obtained from the March 23 event is preliminary. The minimum dissolved oxygen recorded during Drift #4 was 11.11 mg/L at a depth of 12. meters, 2,100 meters down current of the MRP (recorded by a miniDOT sensor on the CTD). There was no significant fluctuation observed at all three depths during Drift #4,

including when the buoy passed within 2.9 meters of the MRP. At the 12 meter depth DO was 11.9 mg/L when the buoy passed closest to the MRP, and was 11.58 mg/L at the location coinciding with the highest recorded CH<sub>4</sub> values (750 meters down current of the MRP, see next section). Drift #1, #2 and #3 also displayed little fluctuation in DO concentrations along the drift tracks at the three depths. The lowest DO values recorded down current of MRP during the three drifts were as follows: Drift #1 = 9.07 mg/L at a depth of 2 meters, Drift #2 = 8.08 mg/L at a depth of 12 meters, and Drift #3 = 8.06 mg/L at a depth of 2 meters.

- Dissolved Methane – Review of the data obtained from the March 23 event is preliminary. SLR is returning to the MRP on March 29 to attempt to repeat the data collection scenario. In addition, samples near the MRP will be collected at three depths (surface, middle and deep) for laboratory analysis. Preliminary evaluation indicates on March 23 the highest CH<sub>4</sub> concentration recorded was 28.4 mg/L at a depth of 7 meters, which occurred during Drift #4 approximately 750 meters down current of the MRP. The CH<sub>4</sub> concentration steadily declined after that point but was still above 15 mg/L at the end of drift, approximately 3,000 meters down current of the MRP. Drift #02 passed nearly as close the MRP (3.3 meters east versus 2.9 meters east) but recorded significantly lower concentrations. The maximum CH<sub>4</sub> recorded was 0.6 mg/L. These two drifts were both conducted in flowing conditions, approximately 2 hours before and 1 hour after slack tide, respectively. Thus, conditions and the drift pattern were similar. The variability in the measurements suggest the dissolved CH<sub>4</sub> concentrations in close proximity to the release point are highly variable (not steady state) due to the dynamic water conditions. Furthermore, other buoy drifts passing farther laterally from the MRP (10 to 166 meters) have recorded much lower maximum CH<sub>4</sub> concentrations (on the order of 0.05 to 0.01 mg/L) suggesting the lateral extent (width) of the elevated CH<sub>4</sub> concentrations is very limited. These interpretations are preliminary.

The 18 AAC 70 Alaska Water Quality Standards for marine waters state the surface DO concentration in coastal waters may not be less than 6.0 mg/L for a depth of one meter except when natural conditions cause this value to be depressed. DO may not be reduced below 4 mg/L at any point beneath the surface. DO concentrations in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed. The lowest measured DO concentration during all four drifts on March 23, 2017 was well above the lower regulatory limit for DO based on a preliminary review. Total DO concentrations, as a percent of solubility, will be report at a later date; preliminary analysis indicates these do not exceed 110%, per 18 AAC 70.20(b)(A)(15).

There are no 18 AAC 70 water quality standards for dissolved CH<sub>4</sub> or CO<sub>2</sub>.

### ***Buoy Transects-Week 1 (Additional Information)***

Some differences between oxygen sensor readings (miniDOT versus SeaBird probe) were noted during the first water quality monitoring effort. Since the sensors were located at different depths in the water column, initially it was not determined whether differences were the result of instrument icing issues, calibration differences, or variations of DO in the water column. The primary

difference was that the DO concentrations from the SeaBird CTD appeared low compared to the MiniDOT loggers. Upon further review after the first and second event, it was determined that the primary reason for the variation was the SeaBird DO readings were low as a result of calibration issues. The SeaBird probe was subsequently bench calibrated, and the raw data from the 1st monitoring event were reprocessed with the revised calibration information resulting in background DO concentrations that were very similar throughout the water column.

As discussed in Week #1 report, this buoy track provides a good representation of the site conditions at and near slack water in close proximity to the MRP, one day prior to a neap tide. Thus, mixing and dilution effects would be anticipated to less than other deployments. The lowest DO values were recorded on the sensor deployed with the CTD at depth of 12.5 meters on Drift #3. DO started at a concentration of approximately 11.8 mg/L and decreased to a low of 10.0 mg/L, then rose back to 11.7 mg/L. The zone of depressed DO was on the order of 150 meters long. The buoy passed through this zone from 11:00 to 11:06, and the buoy was traveling at approximately 50 cm/sec at this time. The DO sensors at 7 and 2 meters depths had minimum detected DO concentrations of 12.03 and 11.78 mg/L, respectively.

### ***Laboratory Results***

Laboratory sample results CH<sub>4</sub> and CO<sub>2</sub> from the first water sampling event on March 18 are provided in Table A-3. These samples were collected down current of the MRP at several depths (surface, middle and deep). The location of these sampling stations is shown on Figure A-2 (distance from the two stations to the MRP was estimated to be 518 and 741 meters).

These samples were submitted to ALS Environmental in Simi Valley, California (ALS) for analysis. ALS maintains National Environmental Laboratory Accreditation Program (NELAP) and Department of Defense Environmental Laboratory Accreditation Program certification for CH<sub>4</sub> and CO<sub>2</sub> analysis (method RSK 175). A preliminary review of the data was performed. The carbon dioxide result for sample CW01M of 1.380 mg/L was qualified "MH" and is considered an estimate with a potential high bias because a matrix spike and matrix spike duplicate sample recovered slightly above the upper control limit. No other qualifications have been made and all data were considered usable. A more formal review of the data will be performed and documented in a Quality Assurance Review report for inclusion with project end reporting documents.

As shown in table A-2, the CH<sub>4</sub> concentration ranged from non-detectable to 0.0027 mg/L. The highest detection was reported in sample CW02D, which was collected at 12 meters bws, approximately 1 hour before the slack tide. This sample also contained the highest CO<sub>2</sub> concentrations. However, overall the CO<sub>2</sub> showed little variation with concentrations ranging from 1.4 to 1.7 mg/L. In-situ measurements of CO<sub>2</sub> by the Pro-Oceanus digital probes are of a similar magnitude. The laboratory results for CH<sub>4</sub> are slightly lower than those detected in-situ with the CH<sub>4</sub> probe. These variations may be the result of the varied data collection methods, methods of analysis (including instruments response time), and variably in the time of collection and location.



## 2.3 Activities Planned for the Next Sampling Event

The next water quality sampling event is planned for March 29, 2017. This event will approximately coincide with a spring tide, and the data gathering effort will occur around a projected minus tide of 3.0 meters below mean lower low water (MLLW). Planned activities include:

- Conducting deployments of the water quality buoy, with one deployment around the slack tide and one or more in flowing conditions.
- Additional water samples for laboratory analysis may be collected closer to the MRP than previous sampling events.

These planned activities may need to be modified due to site conditions and logistics.

## 3.0 AIR/WATER INTERFACE MONITORING

### 3.1 Activities Completed

March 21 through 23, 2017 were primarily setup, calibration, and verification of instrument performance that consisted of incremental testing of the sampling equipment and data transmission. On March 23, Aridea Solutions (Aridea) participated in water quality sampling to refine techniques for deployment and retrieval of the air/water interface buoy system.

The air/water interface sampling was conducted on March 24, 2017. The field team consisted of two SLR and two Aridea scientists. After completion of sampling, the sensor calibration and integrity was assessed to verify acceptable performance. Sensors were found to be responding appropriately, but it was determined that some adjustment to the sampling system was necessary. The sensor splash guards were removed to improve air flow for sample collection and sensors were re-calibrated at ambient temperatures. Follow-up sampling after removal of the splash guards and sensor calibration was planned for March 26, but was limited to a single launch due to issues during the acoustics program, which was conducted simultaneously.

The data collection activities followed the Air/Water Interface Sampling Plan. The primary data collection method utilized a drifting instrumented buoy to obtain air / water quality parameters in the area of interest. The primary instruments are listed below:

- RKI Instruments S2 LEL Transmitter / Detector – collects data every minute
- RKI Instruments S2 LEL Methane (CH<sub>4</sub>) Transmitter / Detector – collects data every minute
- RKI Instruments S2 Carbon Dioxide (CO<sub>2</sub>) Transmitter / Detector – collects data every minute
- RKI Instruments S2 Oxygen (O<sub>2</sub>) Transmitter / Detector – collects data every minute
- Pro-Oceanus Mini Methane (CH<sub>4</sub>) - Submersible pCH<sub>4</sub> sensor and datalogger – collects data every minute
- In-Situ AquaTroll® 600 Multiparameter Sonde – Water temperature, conductivity, dissolved oxygen, salinity – collects data every minute

- Garmin WAAS differential global positioning system (mounted on buoy and used to track the buoy's position during a monitoring transect) – collects data every minute.

Conditions during the buoy launches were:

- All of the buoy launches were conducted during periods where the launch and transect areas were free from ice.
- Air temperature varied between -3 and 2 °C.
- Water temperatures were approximately -1.5 °C.

On March 24, 2017, five buoy drifts (monitoring transects) were completed through the area surrounding the MRP at differing tidal stages. One buoy drift was completed on March 26, 2017. The duration of each drift varied from approximately 20 to 60 minutes, depending upon the tidal flow. Plots of the drifts are illustrated on Figure B1 in Attachment B. During the drifts, the closest distance the buoy passed near the MRP varied between approximately 15 and 137 meters. Table B1 in Attachment B provides a summary of the buoy deployments.

### 3.2 Preliminary Summary of Results

Due to the short period between the monitoring event and initial reporting date, all of the data collected during the first sampling event has not been fully reviewed, analyzed and compiled for reporting. A brief description of each buoy deployment is provided, followed by a general discussion of the preliminary results.

During Drift #1 on March 24, the air/water interface buoy was deployed on the flood tide up current of MRP at 13:21. It was retrieved approximately 20 minutes later down current of the MRP. During the drift, the buoy passed north of the MRP. At its closest point, the buoy came within 61 meters of the estimated MRP. Table B2 in Attachment B provides a summary of measurements obtained during the buoy deployment.

During Drift #2 on March 24, the air/water interface buoy was deployed on the flood tide up current of MRP at 14:05. It was retrieved approximately 21 minutes later down current of the MRP. During the drift, the buoy passed south of the MRP. At its closest point, the buoy came within 138 meters of the estimated MRP. Table B3 in Attachment B provides a summary of measurements obtained during the buoy deployment.

During Drift #3 on March 24, the air/water interface buoy was deployed on the flood tide up current of MRP at 14:48. It was retrieved approximately 27 minutes later down current of the MRP. During the drift, the buoy passed south of the MRP. At its closest point, the buoy came within 89 meters of the estimated MRP. Table B4 in Attachment B provides a summary of measurements obtained during the buoy deployment.

During Drift #4 on March 24, the air/water interface buoy was not launched, but instead was held in the water near surfacing bubbles by the boat crane as the tide slowed from flood to slack between 15:30 and 16:22. Twenty-three minutes into the drift, the buoy was removed from the water for four

minutes and repositioned more directly over the surface bubbles. During Drift #4, the buoy ranged from 15 to 612 meters from the MRP. Table B5 in Attachment B provides a summary of measurements obtained.

During Drift #5 on March 24, the air/water interface buoy was deployed on the ebb tide up current of MRP at 16:50. It was retrieved approximately one hour later down current of the MRP. During the drift, the buoy passed north of the MRP. At its closest point, the buoy came within 74 meters of the estimated MRP. Table B6 in Attachment B provides a summary of measurements obtained during the buoy deployment.

During Drift #1 on March 26, the air/water interface buoy was deployed on the ebb tide up current of MRP at 10:35. It was retrieved approximately 49 minutes later down current of the MRP. During the drift, the buoy passed north of the MRP. At its closest point, the buoy came within 100 meters of the estimated MRP. Table B7 in Attachment B provides a summary of measurements obtained during the buoy deployment.

For dissolved methane (dissolved  $\text{CH}_4$ ), measurements were primarily 0% throughout the tested area. There were five non-zero dissolved  $\text{CH}_4$  readings within the vicinity of the release, but 0% dissolved  $\text{CH}_4$  was measured at a greater frequency. Shortly after the non-zero detections, suspected anomalous readings toggling between 100% and 0% were measured. Upon returning to the dock, routine inspections of the instruments led to the discovery of a silt-filled, compromised membrane on the dissolved  $\text{CH}_4$  sensor. A new membrane was ordered and installed and the team will return to the source area on Wednesday, March 29 to validate the non-zero detections recorded on Friday, March 24.

Actual air measurements obtained for methane ( $\text{CH}_4$ ), LEL, and carbon dioxide ( $\text{CO}_2$ ) revealed results below the sensitivity of the sensors (lower limit of detection, LDL). Sensors for these parameters were originally selected to ensure quantitative measurement of potentially high concentrations associated with sampling directly at the MRP. However actual observations were considerably lower than initial expectations even when sampling directly at the MRP. All measurements below the LDL for these parameters are reported as less than the parameter-specific LDL.

- Dissolved  $\text{CH}_4$ : The LDL for dissolved  $\text{CH}_4$  is 0.1 mg/L. Given the low sensitivity of available sensors, low expected concentration of dissolved  $\text{CH}_4$ , and slow equilibration time for the measurement, no adjustment to the dissolved  $\text{CH}_4$  sensor is planned.
- $\text{CH}_4$ : The LDL for  $\text{CH}_4$  is 1% volume (as LEL) or 10,000 ppm  $\text{CH}_4$ . No information regarding toxicity in marine mammals is available, however according to information provided to SLR by Eco49, the National Research Council (1984), animals (mice and lab rats) exposed to methane at 10,000 ppm showed no toxic effects, and there is no potential for systemic toxicity in mammals. To further evaluate the presence of  $\text{CH}_4$  near the MRP, a more sensitive  $\text{CH}_4$  sensor was acquired and installed on the air / water interface buoy. The first deployment with the more sensitive  $\text{CH}_4$  sensor is planned for March 29, 2017.

- LEL: The LDL for LEL is 2%. LEL results indicate methane concentrations are below 2% (equates to 10,000 ppm CH<sub>4</sub>), providing evidence of a safe working environment. No adjustment to the LEL sensor is planned.
- CO<sub>2</sub>: The LDL for CO<sub>2</sub> is 0.1% or 1,000 ppm. Established global background CO<sub>2</sub> concentrations are expected to be approximately 400 ppm. The current sensor provides the ability to characterize significant increases in CO<sub>2</sub> concentrations. No adjustment to the CO<sub>2</sub> sensor is planned.

### **3.3 Activities Planned for the Next Sampling Event**

The next air / water interface sampling event is planned for March 29, 2017. Planned activities include conducting deployments of the air / water interface buoy with the sensor splash guard removed to improve air-flow to sensors and using a more sensitive CH<sub>4</sub> sensor installed to reduce the level at which measurable CH<sub>4</sub> concentrations in air may be observed. In addition, measurements obtained for dissolved CH<sub>4</sub> will be validated with the newly installed membrane. These planned activities may need to be modified due to site conditions and logistics.

### **REFERENCES**

SLR International Corporation (SLR). 2017a Water Quality Sampling Plan. Cook Inlet Alaska Methane Pipeline Leak, March 2017.

SLR. 2017b. Air/Interface Sampling Plan. Cook Inlet Alaska Methane Pipeline Leak, March 2017

**ATTACHMENT A:**

Figure A-1: Water Quality Monitoring Buoy Schematic (March 23), 2017

Figure A-2: Water Quality Sample Event 2, Buoy Tracks and Water Sample Locations

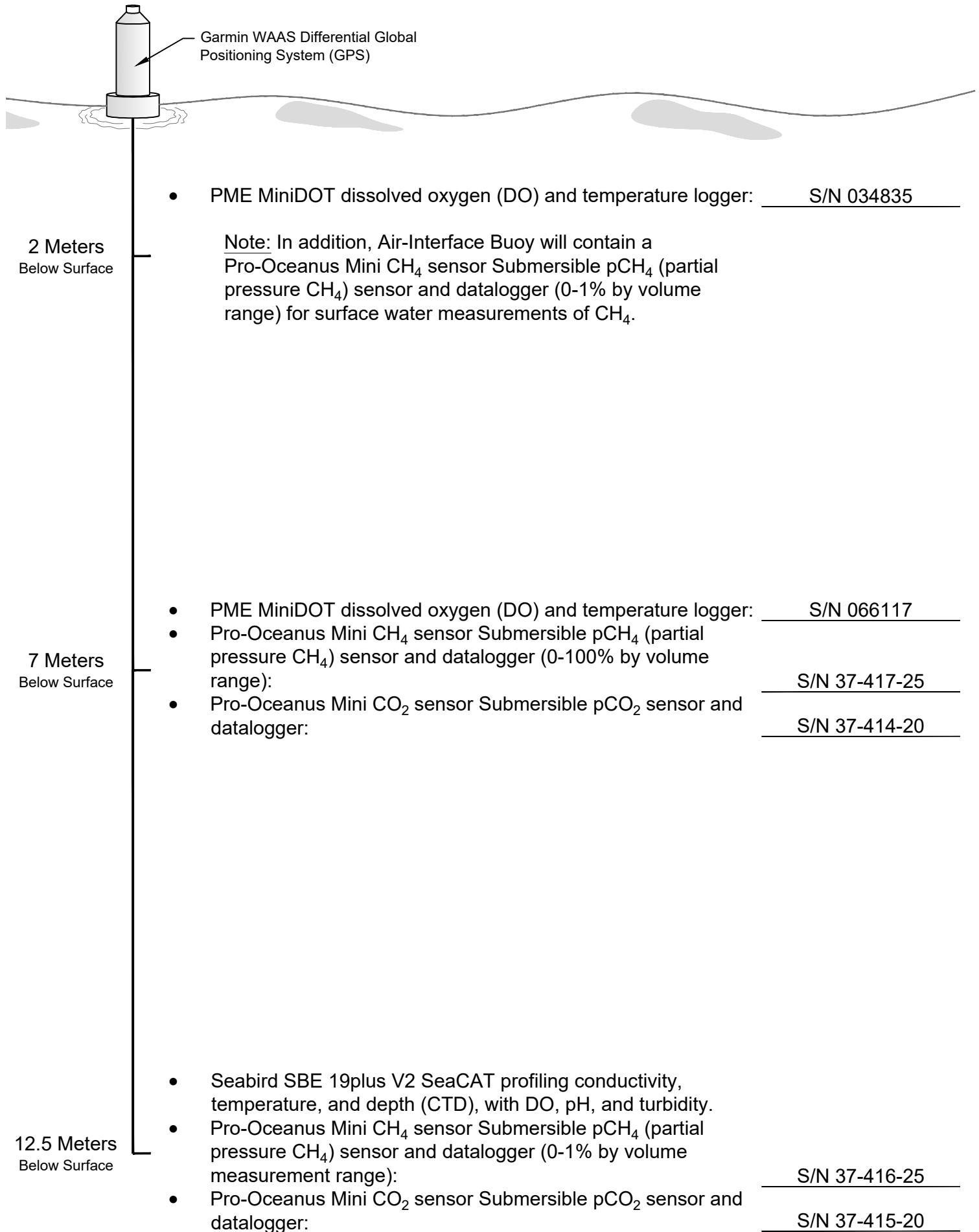
Table A-1: Water Quality Buoy Instrumentation Summary

Table A-2: Summary of Water Quality Buoy Drifts

Table A-2: Water Sample Analytical Results, Pipeline Leak Area, Cook Inlet, Alaska

Water Quality and Air/Water Interface Photograph Log (March 23 to March 24, 2017)

**FIGURE 1: WATER QUALITY MONITORING BUOY SCHEMATIC  
(MARCH 18-19, 2017)**



Base map referenced from National Oceanic and Atmospheric Administration (NOAA),  
Chart 16663, Alaska - South Coast, Cook Inlet, East Foreland to Anchorage (Scale 1:100,000).  
  
Soundings in Fathoms (Fathoms and Feet to Eleven Fathoms at Mean Lower Low Water)  
  
1 Fathom = 6 Feet = 1.8 Meters

Legend

Methane Release Point (MRP)

1000 Yard Restricted Zone

Pipeline

Monitoring Buoy Drift, Tide Current Direction Indicated

3/23/2017 Drift #1

3/23/2017 Drift #2

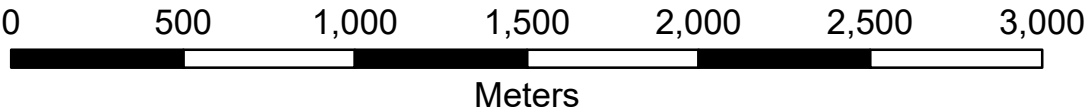
3/23/2017 Drift #3

3/23/2017 Drift #4

Water Sample Location

Arrow = Current Direction at Time of Collection

Water Quality Sample for Laboratory Analysis



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY.  
ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

Project	HILCORP ALASKA, LLC METHANE PIPELINE LEAK COOK INLET, ALASKA		
Drawing	WATER QUALITY MONITORING EVENT 2- BOUY DRIFT TRACKS AND CUMULATIVE WATER QUALITY SAMPLE LOCATIONS		
Drawing Date	March 2017	Scale	1:22,000
File Name	Figure A2 Methane Release_Event2a.mxd	Project No.	105.00874.17015
Fig. No.	A-2		



**Table A-1: Water Quality Instrumentation Buoy Summary**

Instrument Name	Parameters Measured	Measurement Unit	Measurement Frequency	Frequency Reported Plotted Data Analysis Figures	Notes
PME MiniDOT	Temperature	degrees Celsius (°C)	Once per minute	Once per minute	Unable to record at higher frequencies
	Dissolved Oxygen	milligrams per liter (mg/L)			
Pro-Oceanus MiniCO2	Partial pressure of CO2 in detector	Parts per million by volume (ppmv)	Once per 2 seconds	Once per 2 seconds	Note this is an gaseous phase concentration, which can be converted to aqueous concentrations.
	Detector total pressure	millibars			
	Detector temperature	degrees Celsius (°C)			
Pro-Oceanus MiniCH4 (two instruments utilized, with differing ranges 0-1% and 0-100%)	Partial pressure of CH4 in detector	Volume ratio (%)	Once per 2 seconds	Once per 2 seconds	Note this is a gaseous phase concentration, which can be converted to aqueous concentrations.
	Detector total pressure	millibars			
	Detector temperature	degrees Celsius			
Seabird SBE 19plus V3 SeaCat	Depth	meters (M)	4 per second	Data averaged into 5 second intervals	
	Pressure	decibar (dm)			
	Conductivity	Siemens per meter (S/m)			
	Temperature	degrees Celsius (°C)			
	pH	Negative of the base 10 logarithm of the molar concentration of hydrogen			
	Optical backscatter (OBS)	Nephelometric Turbidity Units (NTU)			
	Dissolved Oxygen	milligrams per liter (mg/L)			
Garmin WAAS	Position	Latitude and longitude	Once per 2 seconds	Once per 2 seconds	



**Table A-2: Summary of Water Quality Buoy Drifts**

Buoy Type	Instrument(s) Depth (m)		Drift Name	General Tide Description	Date	Release Time	Release Location			Retrieval Time	Retrieval Location			Drift Duration (hrs:min)	Minimum Distance to MRP (m)	Wind (Knots/direction)	Wave Height (m)
Water Quality	Surface	2	D01-031817	Ebb	3/18/2017	14:50	60	46.622	N	15:20	60	45.356	N	0:30	185	calm	0
	Mid	7					151	25.718	W		151	27.877	W				
	Deep	12.5															
Water Quality	Surface	2	D01-031917	Flood	3/19/2017	8:15	60	46.37	N	8:40	60	47.2	N	0:25	45	15, SSW	0
	Mid	7					151	26.239	W		151	25.112	W				
	Deep	12.5															
Water Quality	Surface	2	D02-031917	Flood	3/19/2017	9:08	60	46.35	N	9:37	60	46.921	N	0:29	170	15, SSW	0
	Mid	7					151	25.878	W		151	25.878	W				
	Deep	12.5															
Water Quality	Surface	2	D03-031917	End of Flood/Slack/Ebb	3/19/2017	9:55	60	45.527	N	11:55	60	45.527	N	2:00	9.8	15, SSW	0.2
	Mid	7					151	23.097	W		151	23.097	W				
	Deep	12.5															
Water Quality	Surface	2	D01-032317	Flood	3/23/2017	12:07	60	46.565	N	12:30	60	47.479	N	0:23	71	0.4 SSW	0
	Mid	7					151	25.995	W		151	24.660	W				
	Deep	12.5															
Water Quality	Surface	2	D02-032317	Flood	3/23/2017	13:10	60	46.393	N	13:57	60	47.755	N	0:47	3.3	Calm	0
	Mid	7					151	26.33	W		151	26.248	W				
	Deep	12.5															
Water Quality	Surface	2	D03-032317	Flood/Slack	3/23/2017	15:29	60	46.781	N	16:26	60	46.537	N	0:57	166	Calm	0
	Mid	7					151	25.884	W		151	26.248	W				
	Deep	12.5															
Water Quality	Surface	2	D04-032317	Ebb	3/23/2017	16:31	60	46.695	N	17:18	60	45.403	N	0:47	2.6	Calm	0
	Mid	7					151	25.870	W		151	27.936	W				
	Deep	12.5															

**Table A-2: Water Sample Analytical Results  
Methane Pipeline Leak Area, Cook Inlet, Alaska**

Sample ID	Date	Time	Sample Depth (m)	Depth to Bottom (m)	Sample Distance Down Current From MRP (m) <sup>1</sup>	Tide Stage	Analytical Results	
						(ebb,flood, or slack (+/-1hr)	RSK 175 - methane (mg/L)	RSK 175 - carbon dioxide (mg/L)
CW01S	3/18/2017	1131	1	24	518	Ebb	0.0024	1.4
CW01M	3/18/2017	1130	9				0.0026	1.4 MH
<b>Primary:</b> CW01D	3/18/2017	1130	23				0.0019	1.3
<b>Duplicate:</b> CW91D	3/18/2017	1130	23				0.0019	1.4
CW02S	3/18/2017	1613	1	20.6	741	~1hr before slack tide, on the Ebb	ND [0.0013]	1.6
CW02M	3/18/2017	1615	6				ND [0.0013]	1.6
CW02D	3/18/2017	1617	12				0.0027	1.7
CW03S	3/23/2017	1418	1	24	177	Flood	pending analysis	
CW03M	3/23/2017	1418	12				pending analysis	
CW04S	3/23/2017	1520	1	24	257	~1hr before slack tide, on the flood	pending analysis	
CW04M	3/23/2017	1520	9				pending analysis	
CW04D	3/23/2017	1520	23.5				pending analysis	

**Notes:**

1 - All samples collected down current of the MRP unless otherwise noted (including those listed as collected near slack tide)

**Abbreviations:**

"--" parameter was not measured  
m meters  
mg/L miligrams per liter  
MRP Methane Release Point

**Analytical Data Flags:**

ND Nondetect, method reporting limit (MRL) in brackets  
M (H,L,or N) Analyte result is considered an estimated value biased (high, low, uncertain)

Cook Inlet Water Quality and  
Air/Water Interface Sampling  
Photo Log: Week 2  
3-23-17 to 3-24-17

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**Photo 1:** Conditions during drift #1

**Date:**  
3/23/2017



**Photo 2:** Drift #2 deployment conditions

**Date:**  
3/23/2017



Cook Inlet Alaska Methane Pipeline Leak  
Water Quality Sampling Report: Week 1

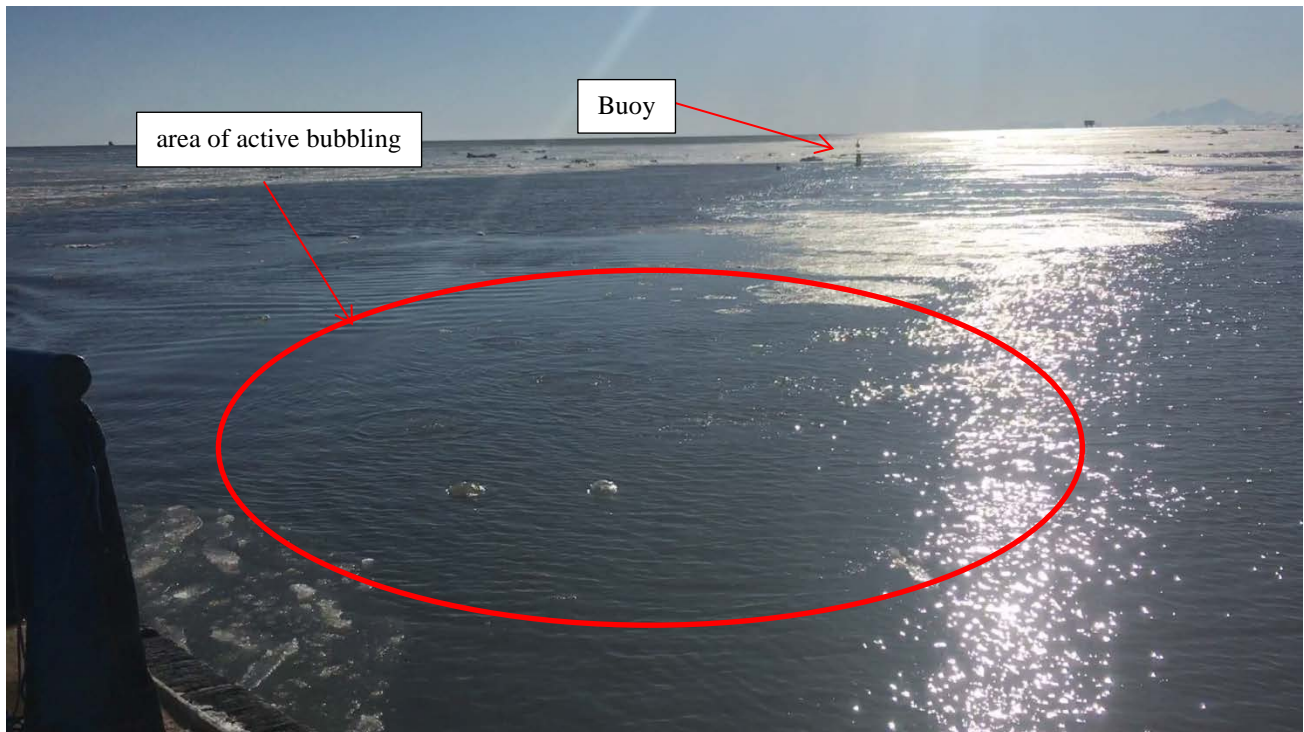
SITE PHOTOGRAPHS

Job No: 105.00874.17021



**Photo 3:** Drift #2 recovery conditions

**Date:**  
3/23/2017



**Photo 4:** Snapshot of Drift #4, showing proximity to methane bubbles

**Date:**  
3/23/2017



Cook Inlet Alaska Methane Pipeline Leak  
Water Quality Sampling Report: Week 1

SITE PHOTOGRAPHS

Job No: 105.00874.17021





**Photo 5:** Deploying the Air/Water Interface Buoy

**Date:**  
3/24/2017



**Photo 6:** Air/Water Interface deployment conditions

**Date:**  
3/24/2017



SITE PHOTOGRAPHS

Cook Inlet Alaska Methane Pipeline Leak  
Water Quality Sampling Report: Week 1

Job No: 105.00874.17021



**Photo 7:** Air/Water Interface deployment conditions

**Date:**  
3/24/2017



SITE PHOTOGRAPHS

Cook Inlet Alaska Methane Pipeline Leak  
Water Quality Sampling Report: Week 1

Job No: 105.00874.17021

**ATTACHMENT B:**

Figure B1: Air / Water Interface Sampling Events, Buoy Tracks March 24 and March 26, 2017

Table B1: Summary of Air / Water Interface Buoy Drifts

Table B2: Buoy Drift 1 March 24, 2017 Measurements

Table B3: Buoy Drift 2 March 24, 2017 Measurements

Table B4: Buoy Drift 3 March 24, 2017 Measurements

Table B5: Buoy Drift 4 March 24, 2017 Measurements

Table B6: Buoy Drift 5 March 24, 2017 Measurements

Table B7: Buoy Drift 1 March 26, 2017 Measurements

Photo Log: See Attachment A

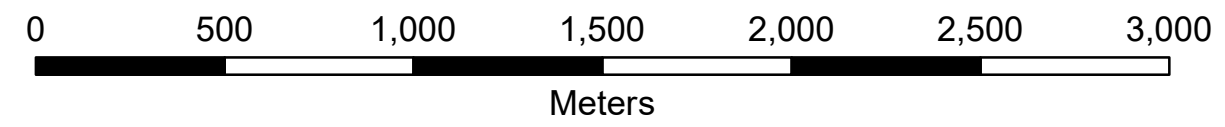
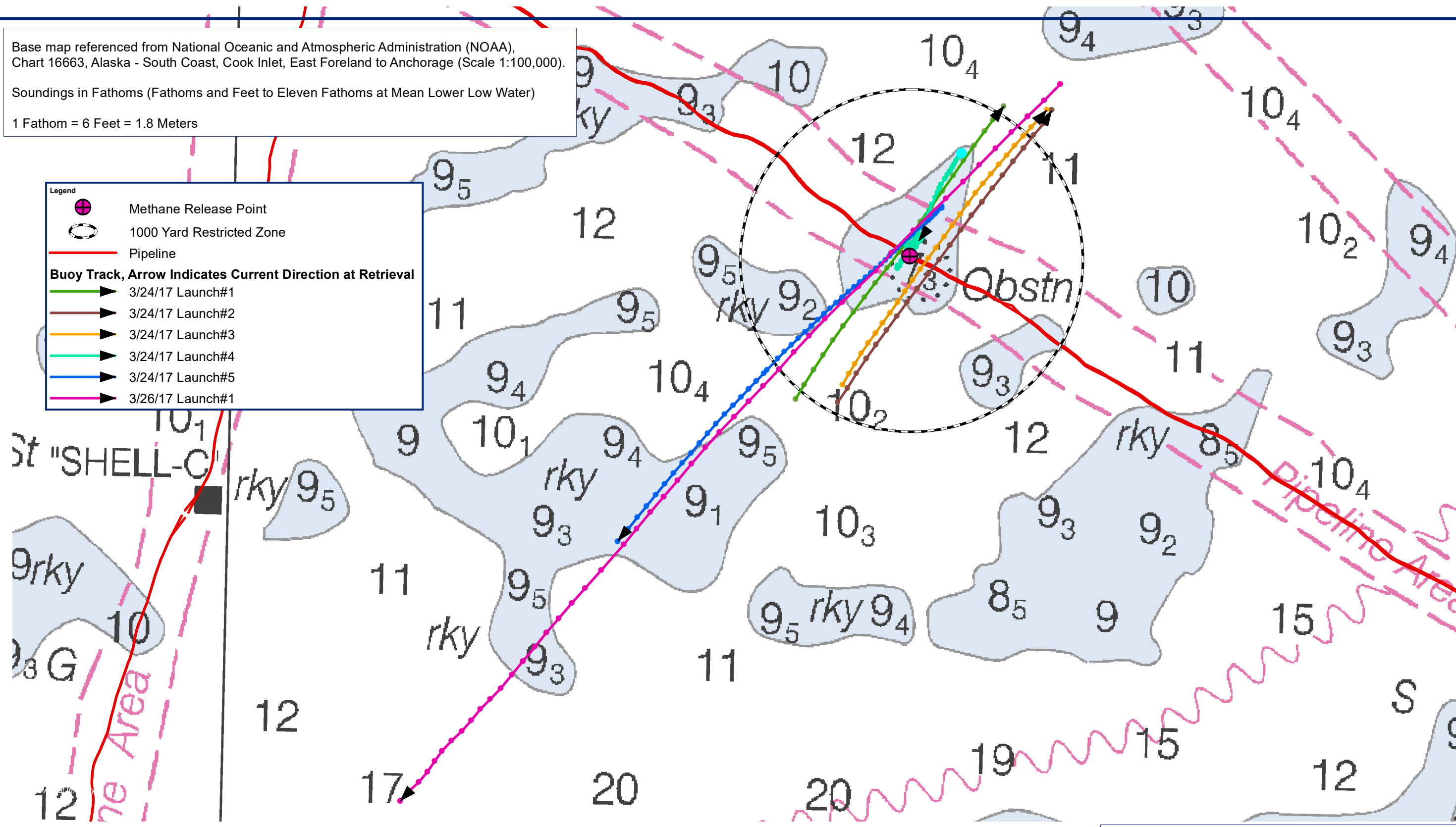


Base map referenced from National Oceanic and Atmospheric Administration (NOAA), Chart 16663, Alaska - South Coast, Cook Inlet, East Foreland to Anchorage (Scale 1:100,000).

Soundings in Fathoms (Fathoms and Feet to Eleven Fathoms at Mean Lower Low Water)

1 Fathom = 6 Feet = 1.8 Meters

- Legend
- Methane Release Point
  - 1000 Yard Restricted Zone
  - Pipeline
- Buoy Track, Arrow Indicates Current Direction at Retrieval**
- 3/24/17 Launch#1
  - 3/24/17 Launch#2
  - 3/24/17 Launch#3
  - 3/24/17 Launch#4
  - 3/24/17 Launch#5
  - 3/26/17 Launch#1



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY.  
ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

Site HILCORP ALASKA, LLC METHANE PIPELINE LEAK COOK INLET, ALASKA			
Drawing Air / Water Interface Sample Event 1 Air / Water Interface Buoy Tracks			
Drawing March 2017	Scale 1:20,000	Fig. No. B1	
File Name FigureEvent2_AirInterface.mxd	Project No. 105.00874.17015		

**Table B1: Summary for Air / Water Interface Buoy Drifts**

Buoy Type	Drift Name	General Tide Description	Date	Release Time	Release Location	Retrieval Time	Retrieval Location	Drift Duration	Minimum Distance to MRP (m)	Wind (Knots/direction)	Wave Height (m)
Air / Water	D01-032417	Flood	3/24/2017	13:21	60 46.176 N 151 26.504 W	13:41	60 47.032 N 151 25.496 W	0:20	61	calm	0
Air / Water	D02-032417	Flood	3/24/2017	14:05	60 46.169 N 151 26.435 W	14:26	60 47.23 N 151 25.214 W	0:21	138	calm	0
Air / Water	D03-032417	Flood	3/24/2017	14:48	60 46.22 N 151 26.41 W	15:15	60 47.024 N 151 25.243 W	0:27	89	calm	0
Air / Water	D04-032417	End of flood/Slack	3/24/2017	15:30	60 46.64 N 151 25.971 W	16:22	60 46.893 N 151 25.738 W	0:52	15	calm	0
Air / Water	D05-032417	Slack/Start of Ebb	3/24/2017	16:50	60 46.734 N 151 25.848 W	17:47	60 45.756 N 151 27.71 W	0:57	74	calm	0
Air / Water	D01-032617	Ebb	3/26/2017	10:35	60 47.099 N 151 25.169 W	11:24	60 44.995 N 151 28.954 W	0:49	100	5, SSW	0

Table B2: Buoy Drift 1 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 1: Friday, 3/24													
3/24/2017 13:21	60.769603,-151.444732,0.0	-0.96	12.23	41404	24.45	<0.1	<10,000	<0.1%	20.910	<2%	30.98	5.98	975.2
3/24/2017 13:22	60.770301,-151.443923,0.0	-1.06	12.22	41655	24.58	<0.1	<10,000	<0.1%	20.910	<2%	31.33	5.33	886.9
3/24/2017 13:23	60.771038,-151.443038,0.0	-1.24	12.28	41932	24.72	<0.1	<10,000	<0.1%	20.910	<2%	32.77	5.42	792.9
3/24/2017 13:24	60.771747,-151.442138,0.0	-1.25	12.25	41916	24.7	<0.1	<10,000	<0.1%	20.910	<2%	33.22	5.72	701.0
3/24/2017 13:25	60.772468,-151.441192,0.0	-1.27	12.24	41977	24.74	<0.1	<10,000	<0.1%	20.910	<2%	34.17	6	606.6
3/24/2017 13:26	60.773155,-151.440216,0.0	-1.28	12.25	41991	24.74	<0.1	<10,000	<0.1%	20.880	<2%	33.54	5.74	514.3
3/24/2017 13:27	60.773845,-151.439239,0.0	-1.3	12.25	42020	24.76	<0.1	<10,000	<0.1%	20.910	<2%	34.04	5.96	422.1
3/24/2017 13:28	60.774551,-151.438217,0.0	-1.31	12.24	42072	24.79	<0.1	<10,000	<0.1%	20.910	<2%	36.19	6.05	327.3
3/24/2017 13:29	60.775253,-151.437179,0.0	-1.34	12.26	42118	24.81	<0.1	<10,000	<0.1%	20.880	<2%	37.67	6.07	233.4
3/24/2017 13:30	60.775989,-151.436035,0.0	-1.33	12.26	42123	24.82	<0.1	<10,000	<0.1%	20.941	<2%	37.02	6.31	135.8
3/24/2017 13:31	60.776744,-151.434921,0.0	-1.33	12.24	42099	24.8	<0.1	<10,000	<0.1%	20.910	<2%	34.27	6.57	61.3
3/24/2017 13:32	60.777519,-151.433837,0.0	-1.36	NR	42112	24.8	<0.1	<10,000	<0.1%	20.880	<2%	33.11	6.05	104.7
3/24/2017 13:33	60.778244,-151.432861,0.0	-1.37	12.26	42114	24.8	<0.1	<10,000	<0.1%	20.941	<2%	35.78	5.88	192.8
3/24/2017 13:34	60.77898,-151.431808,0.0	-1.37	12.26	42115	24.8	<0.1	<10,000	<0.1%	20.910	<2%	34.83	6.13	289.1
3/24/2017 13:35	60.779731,-151.430786,0.0	-1.39	12.26	42138	24.81	<0.1	<10,000	<0.1%	20.880	<2%	NR	NR	388.0
3/24/2017 13:36	60.780475,-151.429779,0.0	-1.37	12.26	42082	24.78	<0.1	<10,000	<0.1%	20.910	<2%	34.47	6.03	486.3
3/24/2017 13:37	60.781211,-151.428787,0.0	-1.39	12.27	42100	24.79	<0.1	<10,000	<0.1%	20.910	<2%	33.76	5.96	583.8
3/24/2017 13:38	60.781936,-151.427795,0.0	-1.38	12.27	42086	24.78	<0.1	<10,000	<0.1%	20.910	<2%	34.26	5.85	680.3
3/24/2017 13:39	60.782634,-151.426788,0.0	-1.4	12.24	42464	25.02	<0.1	<10,000	<0.1%	20.910	<2%	35.67	5.75	774.8
3/24/2017 13:40	60.783195,-151.425979,0.0	-1.4	12.20	43176	25.48	<0.1	<10,000	<0.1%	20.910	<2%	38.58	5.33	850.7
3/24/2017 13:41	60.783863,-151.424942,0.0	-1.4	12.21	42993	25.36	<0.1	<10,000	<0.1%	20.910	<2%	36.15	5.31	943.3

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

Table B3: Buoy Drift 2 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 2: Friday, 3/24													
3/24/2017 14:05	60.769489,-151.440582,0.0	-1	12.21	43328	25.68	<0.1	<10,000	<0.1%	20.910	<2%	34.16	6.61	869.0
3/24/2017 14:06	60.770187,-151.439666,0.0	-1.1	12.22	43639	25.85	<0.1	<10,000	<0.1%	20.910	<2%	33.31	5.79	777.8
3/24/2017 14:07	60.770896,-151.438827,0.0	-1.2	12.15	44621	26.46	<0.1	<10,000	<0.1%	20.910	<2%	30.4	5.59	687.3
3/24/2017 14:08	60.771625,-151.437896,0.0	-1.22	12.18	43810	25.93	<0.1	<10,000	<0.1%	20.910	<2%	36.08	5.55	593.1
3/24/2017 14:09	60.772308,-151.43695,0.0	-1.25	12.13	44151	26.14	<0.1	<10,000	<0.1%	20.910	<2%	34.69	5.63	503.9
3/24/2017 14:10	60.773002,-151.435974,0.0	-1.28	12.28	42874	25.31	<0.1	<10,000	<0.1%	20.910	<2%	34.58	5.63	414.1
3/24/2017 14:11	60.773681,-151.434997,0.0	-1.33	12.18	43963	26	<0.1	<10,000	<0.1%	20.910	<2%	NR	NR	328.2
3/24/2017 14:12	60.774368,-151.434005,0.0	-1.33	12.17	43995	26.02	<0.1	<10,000	<0.1%	20.910	<2%	36.7	5.64	245.9
3/24/2017 14:13	60.775035,-151.433029,0.0	-1.36	12.16	44009	26.03	<0.1	<10,000	<0.1%	20.910	<2%	36.33	5.68	177.2
3/24/2017 14:14	60.775726,-151.432006,0.0	-1.34	12.15	44007	26.03	<0.1	<10,000	<0.1%	20.910	<2%	36.11	5.72	137.6
3/24/2017 14:15	60.776435,-151.430953,0.0	-1.33	12.14	44002	26.03	<0.1	<10,000	<0.1%	20.910	<2%	34.85	5.81	157.8
3/24/2017 14:16	60.777153,-151.429946,0.0	-1.34	12.21	43983	26.01	<0.1	<10,000	<0.1%	20.910	<2%	34.52	5.96	221.1
3/24/2017 14:17	60.777877,-151.428924,0.0	-1.36	12.15	44059	26.06	<0.1	<10,000	<0.1%	20.910	<2%	36.35	5.85	303.7
3/24/2017 14:18	60.778591,-151.427886,0.0	-1.35	12.14	44021	26.03	<0.1	<10,000	<0.1%	20.910	<2%	36.16	5.77	393.4
3/24/2017 14:19	60.779254,-151.426895,0.0	-1.36	12.14	44036	26.04	<0.1	<10,000	<0.1%	20.910	<2%	37.09	5.48	480.5
3/24/2017 14:20	60.779907,-151.425903,0.0	-1.36	12.15	44042	26.04	<0.1	<10,000	<0.1%	20.910	<2%	36.5	5.44	568.3
3/24/2017 14:21	60.780551,-151.424911,0.0	-1.37	12.15	44034	26.04	<0.1	<10,000	<0.1%	20.910	<2%	36.57	5.5	656.1
3/24/2017 14:22	60.78123,-151.423934,0.0	-1.37	12.14	44050	26.05	<0.1	<10,000	<0.1%	20.910	<2%	37.04	5.59	746.4
3/24/2017 14:23	60.781875,-151.422943,0.0	-1.39	12.15	44042	26.04	<0.1	<10,000	<0.1%	20.910	<2%	38.1	5.27	835.0
3/24/2017 14:24	60.782501,-151.421981,0.0	-1.39	12.14	44049	26.04	<0.1	<10,000	<0.1%	20.910	<2%	37.87	5.16	921.2
3/24/2017 14:25	60.783084,-151.421005,0.0	-1.39	12.17	43998	26.01	<0.1	<10,000	<0.1%	20.910	<2%	40.76	5.16	1004.6
3/24/2017 14:26	60.783718,-151.420242,0.0	-1.41	12.14	44322	26.21	<0.1	<10,000	<0.1%	20.910	<2%	25.61	3.9	1084.3

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

Table B4: Buoy Drift 3 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 3: Friday, 3/24													
3/24/2017 14:48	60.770336,-151.44017,0.0	-0.85	12.05	44435	26.43	<0.1	<10,000	<0.1%	20.910	<2%	35.9	3.03	774.4
3/24/2017 14:49	60.770877,-151.439575,0.0	-0.97	12.08	44746	26.61	<0.1	<10,000	<0.1%	20.910	<2%	23.89	4.25	706.2
3/24/2017 14:50	60.771358,-151.438995,0.0	-1.09	12.09	44951	26.71	<0.1	<10,000	<0.1%	20.910	<2%	33.67	3.72	644.3
3/24/2017 14:51	60.771854,-151.438385,0.0	-1.1	12.08	45041	26.76	<0.1	<10,000	<0.1%	20.910	<2%	33.69	3.83	580.3
3/24/2017 14:52	60.772361,-151.437728,0.0	-1.16	12.09	45162	26.82	<0.1	<10,000	<0.1%	20.910	<2%	32.18	3.92	514.1
3/24/2017 14:53	60.772853,-151.437042,0.0	-1.21	12.09	45229	26.86	<0.1	<10,000	<0.1%	20.910	<2%	33.08	3.98	449.1
3/24/2017 14:54	60.773342,-151.43637,0.0	-1.21	12.08	45260	26.87	38.9	<10,000	<0.1%	20.910	<2%	35.51	4.01	385.1
3/24/2017 14:55	60.773841,-151.435653,0.0	-1.23	12.09	45333	26.92	<0.1	<10,000	<0.1%	20.910	<2%	34.34	4.16	319.8
3/24/2017 14:56	60.774356,-151.434936,0.0	-1.26	12.08	45557	27.05	<0.1	<10,000	<0.1%	20.910	<2%	32.57	4.12	254.1
3/24/2017 14:57	60.774883,-151.434234,0.0	-1.27	12.07	45601	27.08	<0.1	<10,000	<0.1%	20.910	<2%	32.29	4.24	189.6
3/24/2017 14:58	60.775432,-151.433517,0.0	-1.27	12.07	45615	27.09	<0.1	<10,000	<0.1%	20.910	<2%	32.91	4.35	128.6
3/24/2017 14:59	60.775959,-151.4328,0.0	-1.29	12.11	45123	26.76	<0.1	<10,000	<0.1%	20.910	<2%	33.13	4.4	89.2
3/24/2017 15:00	60.7765,-151.432022,0.0	-1.29	12.15	45136	26.77	<0.1	<10,000	<0.1%	20.910	<2%	34.38	4.42	99.3
3/24/2017 15:01	60.777019,-151.431304,0.0	-1.31	12.16	45156	26.78	<0.1	<10,000	<0.1%	20.910	<2%	33.36	4.33	146.4
3/24/2017 15:02	60.777553,-151.430526,0.0	-1.31	12.16	45185	26.8	<0.1	<10,000	<0.1%	20.910	<2%	33.91	4.38	210.3
3/24/2017 15:03	60.778095,-151.429763,0.0	-1.32	12.17	45216	26.81	<0.1	<10,000	<0.1%	20.910	<2%	34.38	4.37	278.5
3/24/2017 15:04	60.77864,-151.429016,0.0	-1.31	12.16	45240	26.83	<0.1	<10,000	<0.1%	20.910	<2%	32.74	4.38	348.3
3/24/2017 15:05	60.779163,-151.428283,0.0	-1.33	12.17	45300	26.87	<0.1	<10,000	<0.1%	20.910	<2%	33.44	4.27	416.9
3/24/2017 15:06	60.779663,-151.427566,0.0	-1.34	12.17	45337	26.89	<0.1	<10,000	<0.1%	20.910	<2%	35.42	4.05	483.6
3/24/2017 15:07	60.780132,-151.426834,0.0	-1.33	12.16	45293	26.86	<0.1	<10,000	<0.1%	20.910	<2%	NR	NR	548.7
3/24/2017 15:08	60.78059,-151.426086,0.0	-1.35	12.17	45343	26.89	<0.1	<10,000	<0.1%	20.910	<2%	38.05	4.09	613.6
3/24/2017 15:09	60.781051,-151.425308,0.0	-1.36	12.15	45352	26.89	<0.1	<10,000	<0.1%	20.910	<2%	39.66	4.11	679.8
3/24/2017 15:10	60.781509,-151.42456,0.0	-1.35	12.17	45357	26.9	<0.1	<10,000	<0.1%	20.910	<2%	37.53	4.03	744.8
3/24/2017 15:11	60.781982,-151.423797,0.0	-1.35	12.17	45371	26.91	<0.1	<10,000	<0.1%	20.910	<2%	38.5	4.18	811.6
3/24/2017 15:12	60.782447,-151.423004,0.0	-1.35	12.16	45387	26.92	<0.1	<10,000	<0.1%	20.880	<2%	40.95	3.92	878.8
3/24/2017 15:13	60.782882,-151.422241,0.0	-1.35	12.15	45412	26.93	<0.1	<10,000	<0.1%	20.910	<2%	41.63	3.9	942.5
3/24/2017 15:14	60.783317,-151.421478,0.0	-1.36	12.14	45434	26.95	<0.1	<10,000	<0.1%	20.910	<2%	40.58	3.81	1006.1
3/24/2017 15:15	60.783729,-151.420715,0.0	-1.36	12.13	45431	26.94	<0.1	<10,000	<0.1%	20.910	<2%	44.48	3.5	1067.9

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

Table B5: Buoy Drift 4 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 4: Friday, 3/24													
3/24/2017 15:30	60.777332,-151.432846,0.0	-0.89	12.12	43797	26.01	<0.1	<10,000	<0.1%	20.910	<2%	104.69	1.51	99.9
3/24/2017 15:31	60.777484,-151.432678,0.0	-1.11	12.06	45194	26.86	<0.1	<10,000	<0.1%	20.910	<2%	44.23	1.03	119.0
3/24/2017 15:32	60.777545,-151.4328,0.0	-1.16	12.05	45294	26.91	<0.1	<10,000	<0.1%	20.910	<2%	44.23	0.64	121.6
3/24/2017 15:33	60.777469,-151.432846,0.0	-1.23	12.03	45499	27.02	<0.1	<10,000	<0.1%	20.910	<2%	44.23	0.57	113.0
3/24/2017 15:34	60.777446,-151.432769,0.0	-1.26	12.02	45818	27.22	<0.1	<10,000	<0.1%	20.910	<2%	44.23	0.72	112.8
3/24/2017 15:35	60.777557,-151.432662,0.0	-1.27	12.03	45758	27.18	<0.1	<10,000	<0.1%	20.910	<2%	44.23	0.7	126.4
3/24/2017 15:36	60.777488,-151.432785,0.0	-1.29	12.03	45794	27.2	<0.1	<10,000	<0.1%	20.910	<2%	44.23	1.07	116.4
3/24/2017 15:37	60.77732,-151.432907,0.0	-1.28	12.01	45871	27.25	3.43	<10,000	<0.1%	20.910	<2%	NR	NR	97.0
3/24/2017 15:38	60.777206,-151.433105,0.0	-1.3	12.01	45989	27.32	3.27	<10,000	<0.1%	20.910	<2%	44.23	1.77	80.6
3/24/2017 15:39	60.776988,-151.4337,0.0	-1.31	12.05	46144	27.42	3.24	<10,000	<0.1%	20.910	<2%	256.34	2.01	46.3
3/24/2017 15:40	60.776977,-151.434127,0.0	-1.32	12.03	46142	27.42	3.21	<10,000	<0.1%	20.910	<2%	256.34	1.05	47.0
3/24/2017 15:41	60.77705,-151.434371,0.0	-1.3	12.03	46141	27.42	<0.1	<10,000	<0.1%	20.910	<2%	256.34	0.85	59.8
3/24/2017 15:42	60.777164,-151.434356,0.0	-1.3	12.03	46191	27.45	<0.1	<10,000	<0.1%	20.910	<2%	256.34	1.14	70.9
3/24/2017 15:43	60.777286,-151.434066,0.0	-1.31	12.03	46208	27.46	<0.1	<10,000	<0.1%	20.910	<2%	256.34	2.03	79.7
3/24/2017 15:44	60.777225,-151.433456,0.0	-1.28	12.02	46201	27.47	<0.1	<10,000	<0.1%	20.910	<2%	108.51	1.94	75.0
3/24/2017 15:45	60.777034,-151.433227,0.0	-1.32	11.97	46262	27.49	3.21	<10,000	<0.1%	20.880	<2%	108.51	1.27	60.8
3/24/2017 15:46	60.776988,-151.433502,0.0	-1.29	12.00	46333	27.55	<0.1	<10,000	<0.1%	20.849	<2%	108.51	0.57	49.3
3/24/2017 15:47	60.776897,-151.433532,0.0	-1.33	12.05	45734	27.15	<0.1	<10,000	<0.1%	20.880	<2%	188.21	1.46	39.3
3/24/2017 15:48	60.776706,-151.433746,0.0	-1.32	12.01	46398	27.58	<0.1	<10,000	<0.1%	20.910	<2%	188.21	0.57	15.2
3/24/2017 15:49	60.776847,-151.43367,0.0	-1.29	12.01	46350	27.56	<0.1	<10,000	<0.1%	20.910	<2%	10.71	1.31	31.4
3/24/2017 15:50	60.777019,-151.433502,0.0	-1.3	11.99	46378	27.58	<0.1	<10,000	<0.1%	20.910	<2%	10.71	1.64	52.5
3/24/2017 15:51	60.777229,-151.433242,0.0	-1.34	11.94	46946	27.93	<0.1	<10,000	<0.1%	20.910	<2%	10.71	1.75	79.5
3/24/2017 15:52	60.777416,-151.432937,0.0	-1.34	11.96	46939	27.93	<0.1	<10,000	<0.1%	20.910	<2%	10.71	1.87	105.4
3/24/2017 15:53	60.777618,-151.432586,0.0	--	--	--	--	--	<10,000	<0.1%	20.910	<2%	35.88	2.2	--
3/24/2017 15:54	60.777713,-151.432403,0.0	--	--	--	--	--	<10,000	<0.1%	20.910	<2%	37.21	0.75	--
3/24/2017 15:55	60.77721,-151.433258,0.0	--	--	--	--	--	<10,000	<0.1%	20.818	<2%	217.16	6.27	--
3/24/2017 15:56	60.776569,-151.434097,0.0	--	--	--	--	--	<10,000	<0.1%	20.880	<2%	214.3	4.4	--
3/24/2017 15:57	60.776092,-151.434799,0.0	-1.24	12.16	46466	27.65	<0.1	<10,000	<0.1%	20.880	<2%	221.93	2.35	74.9
3/24/2017 15:58	60.775981,-151.435043,0.0	-1.24	12.06	46592	27.73	<0.1	<10,000	<0.1%	20.880	<2%	22.22	1.5	92.9
3/24/2017 15:59	60.7761,-151.435012,0.0	-1.28	12.04	46615	27.73	<0.1	<10,000	<0.1%	20.910	<2%	356.75	0.88	82.7
3/24/2017 16:00	60.776336,-151.434646,0.0	-1.3	12.02	46614	27.73	<0.1	<10,000	<0.1%	20.880	<2%	26.76	2.18	51.2
3/24/2017 16:01	60.776615,-151.43431,0.0	-1.3	12.02	46629	27.74	<0.1	<10,000	<0.1%	20.910	<2%	30.4	2.33	25.6
3/24/2017 16:02	60.776901,-151.43399,0.0	-1.31	12.01	46646	27.75	<0.1	<10,000	<0.1%	20.910	<2%	28.88	2.18	36.8
3/24/2017 16:03	60.777183,-151.433685,0.0	-1.32	12.01	46674	27.76	<0.1	<10,000	<0.1%	20.910	<2%	27.32	2.09	67.9
3/24/2017 16:04	60.777442,-151.433395,0.0	-1.32	12.01	46682	27.77	<0.1	<10,000	<0.1%	20.910	<2%	27.04	2.07	99.1
3/24/2017 16:05	60.777702,-151.433105,0.0	-1.32	12.01	46722	27.79	<0.1	<10,000	<0.1%	20.910	<2%	27.04	2.03	131.3
3/24/2017 16:06	60.778034,-151.432785,0.0	NR	NR	NR	NR	NR	NR	NR	NR	NR	27.04	1.94	171.8
3/24/2017 16:07	60.778289,-151.432556,0.0	-1.33	12.00	46716	27.79	<0.1	<10,000	<0.1%	20.880	<2%	27.04	2.01	202.7

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

Table B5: Buoy Drift 4 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 4: Friday, 3/24													
3/24/2017 16:08	60.778545,-151.432296,0.0	-1.33	11.99	46730	27.8	<0.1	<10,000	<0.1%	20.910	<2%	27.04	2.01	234.4
3/24/2017 16:09	60.778804,-151.432037,0.0	NR	NR	NR	NR	<0.1	<10,000	<0.1%	20.941	<2%	27.04	2.01	266.3
3/24/2017 16:10	60.779067,-151.431777,0.0	-1.32	11.99	46735	27.8	<0.1	<10,000	<0.1%	20.910	<2%	27.04	2.03	298.7
3/24/2017 16:11	60.779418,-151.431472,0.0	-1.32	11.98	46759	27.82	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.87	341.1
3/24/2017 16:12	60.779659,-151.431274,0.0	-1.33	11.98	46788	27.83	NR	<10,000	<0.1%	20.910	<2%	27.04	1.87	370.0
3/24/2017 16:13	60.779865,-151.431091,0.0	NR	NR	NR	NR	<0.1	NR	NR	NR	NR	27.04	1.79	394.9
3/24/2017 16:14	60.780036,-151.430923,0.0	-1.21	12.00	46804	27.88	NR	<10,000	<0.1%	20.910	<2%	27.04	1.74	416.0
3/24/2017 16:15	60.780319,-151.430587,0.0	-1.22	11.97	46649	27.77	NR	<10,000	<0.1%	20.910	<2%	27.04	1.64	452.1
3/24/2017 16:16	60.780513,-151.430343,0.0	-1.27	11.99	46776	27.84	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.59	477.1
3/24/2017 16:17	60.780693,-151.430099,0.0	-1.26	11.98	46707	27.8	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.53	500.8
3/24/2017 16:18	60.780864,-151.429885,0.0	NR	NR	NR	NR	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.55	522.9
3/24/2017 16:19	60.781013,-151.429718,0.0	-1.28	11.98	46774	27.84	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.48	541.7
3/24/2017 16:20	60.781192,-151.429519,0.0	-1.28	11.97	46802	27.86	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.4	564.3
3/24/2017 16:21	60.781372,-151.42929,0.0	-1.27	11.97	46826	27.88	<0.1	<10,000	<0.1%	20.910	<2%	27.04	1.51	587.7
3/24/2017 16:22	60.781547,-151.42897,0.0	-1.3	11.99	46798	27.85	<0.1	<10,000	<0.1%	20.910	<2%	61.78	2.44	612.7

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.



Table B6: Buoy Drift 5 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 5: Friday, 3/24													
3/24/2017 16:50	60.778907,-151.430801,0.0	-0.16	11.76	44026	26.34	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.35	307.2
3/24/2017 16:51	60.778987,-151.430786,0.0	NR	NR	NR	NR	NR	<10,000	<0.1%	20.910	<2%	239.22	1.01	315.2
3/24/2017 16:52	60.778915,-151.430969,0.0	-0.93	12.14	45962	27.41	<0.1	<10,000	<0.1%	20.910	<2%	NR	NR	303.2
3/24/2017 16:53	60.778835,-151.431121,0.0	-0.98	11.97	46071	27.47	<0.1	<10,000	<0.1%	20.910	<2%	239.22	0.85	291.3
3/24/2017 16:54	60.778728,-151.431289,0.0	-1.09	11.99	46287	27.58	<0.1	<10,000	<0.1%	20.910	<2%	239.22	0.77	276.4
3/24/2017 16:55	60.778629,-151.431472,0.0	-1.14	11.98	46419	27.65	<0.1	<10,000	<0.1%	20.910	<2%	239.22	0.83	261.9
3/24/2017 16:56	60.77853,-151.431671,0.0	-1.16	11.99	46498	27.69	<0.1	<10,000	<0.1%	20.910	<2%	239.22	0.92	247.1
3/24/2017 16:57	60.778419,-151.431869,0.0	-1.18	11.97	46537	27.71	<0.1	<10,000	<0.1%	20.910	<2%	239.22	0.87	231.1
3/24/2017 16:58	60.778316,-151.432083,0.0	-1.21	11.99	46590	27.74	<0.1	<10,000	<0.1%	20.910	<2%	239.22	0.98	215.7
3/24/2017 16:59	60.778198,-151.432342,0.0	-1.23	11.98	46756	27.84	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.16	197.8
3/24/2017 17:00	60.778076,-151.432632,0.0	-1.25	11.98	46761	27.84	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.22	179.1
3/24/2017 17:01	60.777935,-151.432937,0.0	-1.26	11.99	46767	27.84	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.31	158.8
3/24/2017 17:02	60.777801,-151.433258,0.0	NR	11.99	46804	27.87	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.37	139.7
3/24/2017 17:03	60.777645,-151.433578,0.0	-1.25	11.99	46804	27.87	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.48	119.6
3/24/2017 17:04	60.777473,-151.433914,0.0	-1.24	11.98	46853	27.9	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.44	99.6
3/24/2017 17:05	60.777313,-151.434265,0.0	-1.25	11.99	46835	27.88	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.66	84.9
3/24/2017 17:06	60.777126,-151.434631,0.0	-1.27	11.99	46874	27.91	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.68	74.4
3/24/2017 17:07	60.77695,-151.435012,0.0	-1.27	11.99	46852	27.89	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.79	75.7
3/24/2017 17:08	60.776767,-151.435424,0.0	-1.27	NR	NR	NR	NR	<10,000	<0.1%	20.910	<2%	239.22	1.66	88.3
3/24/2017 17:09	60.776569,-151.435806,0.0	-1.26	11.99	46874	27.91	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.77	106.5
3/24/2017 17:10	60.776371,-151.436203,0.0	-1.27	11.99	46884	27.91	<0.1	<10,000	<0.1%	20.910	<2%	239.22	1.87	130.1
3/24/2017 17:11	60.776165,-151.436645,0.0	-1.27	11.98	46894	27.92	<0.1	<10,000	<0.1%	20.910	<2%	239.22	2	158.8
3/24/2017 17:12	60.775947,-151.437133,0.0	-1.28	11.98	46897	27.92	<0.1	<10,000	<0.1%	20.910	<2%	227.7	2.09	191.8
3/24/2017 17:13	60.77573,-151.437622,0.0	-1.29	11.99	46858	27.89	<0.1	<10,000	<0.1%	20.910	<2%	228.38	2.16	225.7
3/24/2017 17:14	60.775508,-151.43814,0.0	-1.3	11.99	46903	27.92	<0.1	<10,000	<0.1%	20.880	<2%	226.79	2.18	261.8
3/24/2017 17:15	60.775283,-151.43869,0.0	-1.28	11.97	46936	27.94	<0.1	<10,000	<0.1%	20.910	<2%	228.51	2.35	299.9
3/24/2017 17:16	60.775047,-151.439224,0.0	-1.3	11.99	46903	27.92	<0.1	<10,000	<0.1%	20.910	<2%	226.96	2.48	338.1
3/24/2017 17:17	60.774803,-151.439788,0.0	-1.29	11.99	46904	27.92	<0.1	<10,000	<0.1%	20.880	<2%	227.8	2.5	378.3
3/24/2017 17:18	60.774532,-151.440383,0.0	-1.3	11.99	46952	27.95	<0.1	<10,000	<0.1%	20.880	<2%	226.14	2.53	421.6
3/24/2017 17:19	60.774261,-151.440963,0.0	-1.27	11.98	46966	27.97	<0.1	<10,000	<0.1%	20.880	<2%	225.83	2.51	464.5
3/24/2017 17:20	60.77399,-151.441543,0.0	-1.27	11.98	46951	27.96	<0.1	<10,000	<0.1%	20.880	<2%	224.2	2.44	507.5
3/24/2017 17:21	60.773715,-151.442108,0.0	-1.26	11.99	46981	27.98	<0.1	<10,000	<0.1%	20.910	<2%	224.84	2.55	550.1
3/24/2017 17:22	60.773426,-151.442733,0.0	-1.22	11.98	46998	28	<0.1	<10,000	<0.1%	20.910	<2%	225.2	2.68	596.4
3/24/2017 17:23	60.773132,-151.443344,0.0	-1.31	11.99	46930	27.93	<0.1	<10,000	<0.1%	20.910	<2%	221.34	2.48	642.5
3/24/2017 17:24	60.772834,-151.443954,0.0	-1.29	11.99	46970	27.96	<0.1	<10,000	<0.1%	20.880	<2%	223.32	2.72	688.9
3/24/2017 17:25	60.772518,-151.444595,0.0	-1.3	11.98	46953	27.95	<0.1	<10,000	<0.1%	20.880	<2%	224.8	2.77	737.9
3/24/2017 17:26	60.772201,-151.445251,0.0	-1.28	11.99	46958	27.96	<0.1	<10,000	<0.1%	20.880	<2%	224.08	3.01	787.7
3/24/2017 17:27	60.771873,-151.445907,0.0	-1.27	12.00	46984	27.98	<0.1	<10,000	<0.1%	20.910	<2%	224.42	3.01	838.2

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.



Table B6: Buoy Drift 5 March 24, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 5: Friday, 3/24													
3/24/2017 17:28	60.77153,-151.446563,0.0	-1.26	11.98	46970	27.97	<0.1	<10,000	<0.1%	20.941	<2%	222.3	3.16	889.9
3/24/2017 17:29	60.770973,-151.447586,0.0	-1.24	11.98	46983	27.99	<0.1	<10,000	<0.1%	20.880	<2%	220.25	3.22	972.2
3/24/2017 17:30	60.770793,-151.447906,0.0	-1.24	NR	NR	NR	NR	NR	NR	NR	NR	220.98	3.18	998.4
3/24/2017 17:31	60.77042,-151.448623,0.0	-1.24	11.98	46980	27.98	<0.1	<10,000	<0.1%	20.910	<2%	223.41	3.57	1054.9
3/24/2017 17:32	60.770034,-151.44934,0.0	-1.23	11.99	46994	27.99	<0.1	<10,000	<0.1%	20.910	<2%	222.85	3.48	1112.4
3/24/2017 17:33	60.769638,-151.450088,0.0	-1.23	11.98	46976	27.99	<0.1	<10,000	<0.1%	20.910	<2%	221.62	3.57	1171.9
3/24/2017 17:34	60.769237,-151.450851,0.0	-1.23	11.99	46982	27.99	<0.1	<10,000	<0.1%	20.910	<2%	221.4	3.81	1232.5
3/24/2017 17:35	60.768795,-151.45166,0.0	-1.22	11.98	46994	28	<0.1	<10,000	<0.1%	20.910	<2%	221.85	3.98	1298.0
3/24/2017 17:36	60.768341,-151.452468,0.0	-1.21	11.98	47026	28.02	<0.1	<10,000	<0.1%	20.910	<2%	218.27	4.03	1364.4
3/24/2017 17:37	60.767871,-151.453262,0.0	-1.22	11.99	47005	28.01	<0.1	<10,000	<0.1%	20.910	<2%	219.18	4.01	1431.4
3/24/2017 17:38	60.767395,-151.454055,0.0	-1.24	11.99	47006	28.01	<0.1	<10,000	<0.1%	20.910	<2%	219.44	4.07	1499.0
3/24/2017 17:39	60.766914,-151.454849,0.0	-1.23	11.99	47005	28	<0.1	<10,000	<0.1%	20.910	<2%	218.23	4.29	1567.0
3/24/2017 17:40	60.766426,-151.455688,0.0	-1.25	11.99	47018	28.01	<0.1	<10,000	<0.1%	20.910	<2%	219.03	4.12	1637.4
3/24/2017 17:41	60.765914,-151.456527,0.0	-1.26	11.98	46989	27.99	<0.1	<10,000	<0.1%	20.910	<2%	218.31	4.35	1709.7
3/24/2017 17:42	60.765399,-151.457366,0.0	-1.24	11.98	47060	28.03	<0.1	<10,000	<0.1%	20.880	<2%	218.81	4.48	1782.3
3/24/2017 17:43	60.764862,-151.458221,0.0	-1.24	11.98	47013	28.01	<0.1	<10,000	<0.1%	20.910	<2%	216.26	4.24	1857.3
3/24/2017 17:44	60.764316,-151.459091,0.0	-1.24	11.98	47058	28.03	<0.1	<10,000	<0.1%	20.880	<2%	219.7	4.92	1933.5
3/24/2017 17:45	60.763767,-151.459976,0.0	-1.26	11.98	47079	28.05	<0.1	<10,000	<0.1%	20.880	<2%	217.31	4.35	2010.7
3/24/2017 17:46	60.763195,-151.460861,0.0	-1.25	11.98	47116	28.07	<0.1	<10,000	<0.1%	20.910	<2%	NR	NR	2089.7
3/24/2017 17:47	60.762599,-151.461837,0.0	-1.25	11.97	47051	28.03	<0.1	<10,000	<0.1%	20.880	<2%	226.29	5.75	2174.2

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

Table B7: Buoy Drift 1 March 26, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 1: Sunday, 3/26													
3/26/2017 9:35	60.78498,-151.419479,0.0	-1.13	12.38	46194	27.5	<0.1	<10,000	<0.1%	20.925	<2%	224.04	7.13	1217.0
3/26/2017 9:36	60.784172,-151.421005,0.0	-1.23	12.21	45987	27.34	<0.1	<10,000	<0.1%	20.925	<2%	223.41	7.22	1095.0
3/26/2017 9:37	60.78339,-151.422607,0.0	-1.23	12.19	44970	26.68	<0.1	<10,000	<0.1%	20.925	<2%	224.58	7.14	972.6
3/26/2017 9:38	60.782615,-151.424148,0.0	-1.27	12.18	44756	26.53	32.51	<10,000	<0.1%	20.925	<2%	224.14	7.16	853.1
3/26/2017 9:39	60.781826,-151.425674,0.0	-1.3	12.13	44753	26.52	32.51	<10,000	<0.1%	20.925	<2%	223.6	7.16	733.0
3/26/2017 9:40	60.781024,-151.427215,0.0	-1.31	12.12	44601	26.42	<0.1	<10,000	<0.1%	20.925	<2%	222.22	7.35	611.5
3/26/2017 9:41	60.7802,-151.428771,0.0	-1.32	12.14	44455	26.32	<0.1	<10,000	<0.1%	20.925	<2%	223.62	7.16	488.0
3/26/2017 9:42	60.779373,-151.430404,0.0	-1.35	12.14	44400	26.28	<0.1	<10,000	<0.1%	20.925	<2%	223.62	7.77	362.6
3/26/2017 9:43	60.778606,-151.431991,0.0	-1.36	12.13	44299	26.21	<0.1	<10,000	<0.1%	20.925	<2%	226.95	7.11	247.0
3/26/2017 9:44	60.777801,-151.433547,0.0	-1.37	NR	NR	NR	<0.1	<10,000	<0.1%	20.894	<2%	225.28	7.11	137.0
3/26/2017 9:45	60.776706,-151.435668,0.0	-1.37	12.20	43535	25.72	<0.1	<10,000	<0.1%	20.894	<2%	220.84	7.33	100.0
3/26/2017 9:46	60.775844,-151.437194,0.0	-1.39	12.23	43113	25.44	<0.1	NR	NR	NR	NR	222.89	7.57	199.3
3/26/2017 9:47	60.775054,-151.438812,0.0	-1.39	12.15	44300	26.2	<0.1	<10,000	<0.1%	20.894	<2%	225.07	7.16	318.5
3/26/2017 9:48	60.774295,-151.440383,0.0	NR	12.14	44276	26.19	<0.1	<10,000	<0.1%	20.925	<2%	226.38	7.37	436.4
3/26/2017 9:49	60.773483,-151.442016,0.0	-1.4	12.33	41793	24.59	<0.1	<10,000	<0.1%	20.925	<2%	223.23	7.46	561.5
3/26/2017 9:50	60.772659,-151.443527,0.0	-1.4	12.37	41751	24.56	<0.1	<10,000	<0.1%	20.925	<2%	222.81	7.2	682.8
3/26/2017 9:51	60.771842,-151.444992,0.0	NR	NR	NR	NR	<0.1	<10,000	<0.1%	20.925	<2%	220.33	7.09	802.3
3/26/2017 9:52	60.771018,-151.446426,0.0	-1.4	12.37	41700	24.53	<0.1	<10,000	<0.1%	20.925	<2%	221.11	7.24	921.4
3/26/2017 9:53	60.770191,-151.447921,0.0	-1.41	12.37	41726	24.54	<0.1	<10,000	<0.1%	20.925	<2%	223.01	7.01	1043.3
3/26/2017 9:54	60.769443,-151.449325,0.0	NR	NR	NR	NR	<0.1	<10,000	<0.1%	20.925	<2%	NR	NR	1155.9
3/26/2017 9:55	60.768684,-151.450714,0.0	-1.42	12.36	41588	24.45	<0.1	<10,000	<0.1%	20.894	<2%	221.85	6.68	1268.7
3/26/2017 9:56	60.767936,-151.452117,0.0	-1.42	12.37	41528	24.41	<0.1	<10,000	<0.1%	20.925	<2%	221.73	6.61	1381.3
3/26/2017 9:57	60.767181,-151.45346,0.0	-1.42	12.37	41358	24.3	NR	<10,000	<0.1%	20.925	<2%	219.51	6.63	1492.1
3/26/2017 9:58	60.766391,-151.454772,0.0	-1.42	NR	41205	24.2	<0.1	<10,000	<0.1%	20.925	<2%	218.86	6.72	1604.5
3/26/2017 9:59	60.765575,-151.4561,0.0	-1.43	NR	NR	NR	<0.1	<10,000	<0.1%	20.925	<2%	218.89	7.03	1719.7
3/26/2017 10:00	60.764789,-151.457427,0.0	-1.43	NR	NR	NR	<0.1	<10,000	<0.1%	20.925	<2%	219.46	6.61	1832.6
3/26/2017 10:01	60.764019,-151.458709,0.0	NR	12.37	41060	24.11	33.07	<10,000	<0.1%	20.925	<2%	218.25	6.64	1942.5
3/26/2017 10:02	60.763225,-151.460006,0.0	-1.43	12.38	41039	24.1	<0.1	<10,000	<0.1%	20.894	<2%	218.79	6.53	2055.0
3/26/2017 10:03	60.762454,-151.461257,0.0	NR	NR	NR	NR	<0.1	<10,000	<0.1%	20.925	<2%	219	6.44	2163.9
3/26/2017 10:04	60.761199,-151.463394,0.0	NR	NR	NR	NR	2.54	<10,000	<0.1%	20.925	<2%	220.65	6.46	2345.1
3/26/2017 10:05	60.760314,-151.46495,0.0	-1.43	12.38	40951	24.04	33.08	<10,000	<0.1%	20.894	<2%	219.99	6.33	2474.7
3/26/2017 10:06	60.759578,-151.466201,0.0	-1.43	12.38	40936	24.03	<0.1	<10,000	<0.1%	20.925	<2%	NR	NR	2580.9
3/26/2017 10:07	60.758842,-151.467453,0.0	NR	NR	NR	NR	<0.1	<10,000	<0.1%	20.925	<2%	219.95	6.25	2687.2
3/26/2017 10:08	60.758148,-151.468627,0.0	-1.43	12.39	40934	24.03	33.09	<10,000	<0.1%	20.925	<2%	218.23	5.83	2787.1
3/26/2017 10:09	60.757442,-151.469726,0.0	-1.44	12.37	40927	24.02	<0.1	<10,000	<0.1%	20.894	<2%	217.39	5.79	2885.3
3/26/2017 10:10	60.756748,-151.470855,0.0	-1.44	12.37	40959	24.04	<0.1	<10,000	<0.1%	20.894	<2%	219.42	5.72	2983.7
3/26/2017 10:11	60.756088,-151.471939,0.0	-1.44	12.36	40913	24.01	<0.1	<10,000	<0.1%	20.894	<2%	218.2	5.42	3077.6
3/26/2017 10:12	60.755424,-151.472991,0.0	-1.44	12.37	40871	23.99	<0.1	<10,000	<0.1%	20.925	<2%	218.27	5.27	3170.7

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

Table B7: Buoy Drift 1 March 26, 2017 Measurements

**PRELIMINARY Data for March 24 and March 26, 2017 Air/Water Interface Buoy Events****Validity of Data is being checked through Repeat Buoy Launch on 3/29/2017**

AKDT	Location	Temp (C)	DO (mg/L)	Specific Conductance (S/m)	Salinity (PSU)	Dissolved CH4 (mg/L)	CH4 (air) (ppm)	CO2 (%Vol)	Oxygen (%Vol)	LEL (% Vol)	Course (Degrees)	Speed (MPH)	Distance From Leak (Meter)
Launch 1: Sunday, 3/26													
3/26/2017 10:13	60.75489,-151.473968,0.0	-1.44	12.37	40880	23.99	<0.1	<10,000	<0.1%	20.894	<2%	224.15	4.42	3250.3
3/26/2017 10:14	60.754409,-151.474914,0.0	-1.44	12.38	40634	23.83	<0.1	<10,000	<0.1%	20.925	<2%	223.46	4.35	3324.5
3/26/2017 10:15	60.753852,-151.475784,0.0	-1.44	12.38	40631	23.83	<0.1	<10,000	<0.1%	20.894	<2%	219.97	4.55	3402.1
3/26/2017 10:16	60.753326,-151.476715,0.0	-1.44	12.37	40575	23.8	<0.1	<10,000	<0.1%	20.925	<2%	223.52	4.4	3479.4
3/26/2017 10:17	60.752853,-151.477691,0.0	-1.44	12.40	40417	23.7	<0.1	<10,000	<0.1%	20.894	<2%	224.96	4.42	3554.0
3/26/2017 10:18	60.752365,-151.478591,0.0	-1.44	12.38	40496	23.75	33.15	<10,000	<0.1%	20.925	<2%	219.62	4.16	3627.1
3/26/2017 10:19	60.751865,-151.479293,0.0	-1.44	12.35	41074	24.12	33.06	<10,000	<0.1%	20.894	<2%	203.95	3.51	3693.9
3/26/2017 10:20	60.751346,-151.47998,0.0	-1.44	12.37	40945	24.03	<0.1	<10,000	<0.1%	20.894	<2%	211.13	3.98	3761.8
3/26/2017 10:21	60.75085,-151.480789,0.0	-1.45	12.38	40840	23.96	<0.1	<10,000	<0.1%	20.925	<2%	223.99	4.14	3832.2
3/26/2017 10:22	60.750408,-151.481689,0.0	-1.45	12.76	34920	20.21	<0.1	<10,000	<0.1%	20.925	<2%	224.76	4.05	3901.5
3/26/2017 10:23	60.749916,-151.482574,0.0	-1.45	12.40	40931	24.02	<0.1	<10,000	<0.1%	20.925	<2%	222.7	4.18	3974.3

NR - Instrument did not record a reading at this time interval

Blue Highlights - Sensor membrane was compromised. Readings to be verified through repeat study.

-- Buoy was removed from the water and repositioned.

## **ADDITIONAL SAFETY DOCUMENTATION**

## DAILY JOB REPORT

Directions: *Note problems encountered, RFI's, verbal communications with Client's representative, change order work performed.*  
*Note any important events*  
*Send a copy via fax to Nikiski office by 900 am.*

## Work By PEAK:

The work performed by 1 PEAK employee (, Safety Professional!) was to provide HSE support to the personnel obtaining water samples for the Hilcorp Pipeline Gas Leak. HSE support included: JSA, pre-job safety meeting, permit to work, continuous monitoring of three 4-gas meters and continuous safety support.

### Work by Subcontractors:

Work performed by 6 subcontractors, was that of multiple water sampling by 2 SLR employees and 2 Kinnetic Labs employees. There were 2 Aridea employees observing and preparing for testing on 3/24/2017.

### Safety Topic/Injury's

JSA and permit to work were completed for this job. Copy of JSA/permit to work is attached with this daily job report.

Comments:

Time line of events for this job are attached in a word document to this daily job report.

Supervisor

Safety Professional

Signature

to

Report No. 1

Peak Job No. 23054 Date 3/23/2017

Job Name HSE support for water sampling for Gas Pipeline Leak

[illegible]

The follow is a list of events that took place for the Hilcorp pipeline gas leak water sampling on Thursday 3-23-2017:

**1050** – JSA and pre-job safety meeting completed. Vessel safety brief by deck hand

**1055** – Depart Port aboard the Resolution owned and operated by OMSI

**1100** – Weather noted: Sunny skies, wind less than 3 knots, calm seas and temperature at 24\* F. Ice conditions were mostly favorable.

**1105** – Three 4-gas meters were taped to wooden mop handles and taped to the railings of the vessel. The height of all the gas meters ranged between 5'6" and 6'0". One was placed at the bow, one was placed 30 feet towards the rear on the portside of the vessel and one was placed mid-deck on the starboard side of the vessel. The monitors were turned on at this time.

**1210** – First sample taken at 67 meters with 0% LEL on gas meters. (buoy sample)

**1311** – Second sample taken at 443 meters with 0% LEL on gas meters. (buoy sample)

**1418** – Third sample taken at 160 meters with 0% LEL on gas meters. (water sample on side of the boat)

**1521** – Fourth sample taken at 260 meters with 0% LEL on gas meters. (water sample on side of the boat)

**1530** – Fifth sample taken at 388 meters with 0% LEL on gas meters. (buoy sample)

**1630** – Sixth sample taken at 238 meters with 0% LEL on gas meters. (buoy sample)

**1725** – 4-gas meters turned off and vessel headed back to port.

**1740** – Arrived to port and close out of Permit to Work.

There were no injuries/incidents and safety was a focus for all personnel performing today's tasks. Proper use of safety toe boots, hard hats, gloves and fall protection were noted throughout all tasks. A focus on pinch points, crush-by/contact-by and overhead objects were a focus during rigging and work being performed via crane.





## Permit to Work (PTW) / Job Safety Analysis (JSA)

JSA's should be considered prior to any work. JSA's are mandatory for that require the use of Hilcorp Alaska's Permit to Work system.

DATE: 3-23-17 START TIME: 1030 AM END TIME: 1030 PM

FACILITY: N/A LOCATION / AREA: Look Inlet

PROJECT DESCRIPTION: methane Pipeline leak  
Water Quality Sampling

### CONFINED SPACE ENTRY REQUIREMENTS:

The operations team and work team have evaluated the confined space and agree that none of the following conditions exist and a Confined Space Entry Permit is not required. Operations Lead or Permit Issuer Initials: \_\_\_\_\_

- 1) The space does not contain any type of hazardous atmosphere.
- 2) The space does not have the potential to entrap or engulf an entrant.
- 3) The space does not contain any other serious safety or health hazard.

Additional Permits Required: ☐ Hot Work ☐ Confined Space Entry ☐ Isolation of Hazardous Energy ☐ Excavation & Trenching

### HAZARD-CONTROL INDEX (THIS LIST IS NOT EXHAUSTIVE)

<b>SLIPS/TRIPS/FALLS</b> <input checked="" type="checkbox"/> Clean surfaces (housekeeping) <input checked="" type="checkbox"/> Barricade <input checked="" type="checkbox"/> Focus on path <input type="checkbox"/> Use alternate route <input type="checkbox"/> Relocate equipment/project <input type="checkbox"/> Examine scaffolding condition <input checked="" type="checkbox"/> Examine handrail condition  <b>FALLS FROM ELEVATION (4'+)</b> <input type="checkbox"/> Move work to ground level <input type="checkbox"/> Ladder inspections <input type="checkbox"/> Proper ladder material/placement <input checked="" type="checkbox"/> Additional PPE (Fall Protection) <u>falls</u>	<b>PINCH POINTS/SHARP OBJECTS</b> <input checked="" type="checkbox"/> Proper guarding <input checked="" type="checkbox"/> Proper body placement  <b>FIRE/EXPLOSION</b> <input type="checkbox"/> Permitting <input checked="" type="checkbox"/> Air testing/monitoring <input type="checkbox"/> Remove combustible/flam materials <input type="checkbox"/> Fire watch <input type="checkbox"/> Fire extinguishers <input checked="" type="checkbox"/> Additional PPE  <b>HIGH NOISE LEVELS</b> <input type="checkbox"/> Relocate work <input type="checkbox"/> Additional PPE (Hearing protection etc.)	<b>ENERGIZED EQUIPMENT</b> <input checked="" type="checkbox"/> Guarding <input checked="" type="checkbox"/> Proper body placement <input checked="" type="checkbox"/> No loose clothing  <b>REPETITIVE MOTION</b> <input type="checkbox"/> Proper technique/tools <input type="checkbox"/> Ask for assistance <input type="checkbox"/> Work/rest schedule  <b>PRESSURE</b> <input type="checkbox"/> Communication <input type="checkbox"/> Barricading <input type="checkbox"/> Shielding <input type="checkbox"/> Proper body placement <input type="checkbox"/> Block & bleed protocol	<b>ELECTRICAL SHOCK</b> <input type="checkbox"/> Testing <input checked="" type="checkbox"/> Grounding <input checked="" type="checkbox"/> Equipment shielding/condition <input type="checkbox"/> GFCI's <input type="checkbox"/> Examine electrical clearances  <b>LIFTING/PULLING/PUSHING</b> <input checked="" type="checkbox"/> Utilize right tools for job <input checked="" type="checkbox"/> Proper technique <input checked="" type="checkbox"/> Smaller/lighter loads <input checked="" type="checkbox"/> Examine path <input type="checkbox"/> Use alternate route <input type="checkbox"/> Work rest schedule	<b>LOCK-OUT/TAG-OUT CONDITIONS</b> <input type="checkbox"/> Electrical isolation <input type="checkbox"/> Pressure isolation <input type="checkbox"/> Energized equipment isolation <input type="checkbox"/> Fire/explosion isolation  <b>HAZARDOUS CHEMICALS</b> <input type="checkbox"/> Consult MSDS <input type="checkbox"/> Label/store containers correctly <input type="checkbox"/> Spill prevention considered <input type="checkbox"/> Additional PPE (Goggles etc.)  <b>ATMOSPHERIC</b> <input type="checkbox"/> Respirators <input checked="" type="checkbox"/> Testing/monitoring
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WORK TEAM LEADER (print): Environmental Sampler Signature: Environmental Sampler  
PERMIT APPROVER (print): Safety Professional Signature: Safety Professional  
AREA CONTROLLER (print): Vessel Captain Signature: Vessel Captain

Revalidation or Extension Time (4 Hour Max):

Permit Approver (print): \_\_\_\_\_ Time: \_\_\_\_\_  
Signature: \_\_\_\_\_

Close Out Signature: Environmental Sampler  
Work Team Leader: Vessel Captain Time: 5:40 PM  
Area Controller: Vessel Captain Time: 5:40 PM

### Emergency Contact Info

Area controller: Vessel Captain  
Safety: Environmental Hilcorp Safety Professional  
Construction Rep: Hilcorp Environmental Professional  
Emergency Muster Area: Bridge of the vessel

### GENERAL SAFETY CONSIDERATIONS

	Y	N	N/A
Are Standard Operating Procedures available and being followed?	<input checked="" type="checkbox"/>		
Do personnel have proper tools/equipment for the job?	<input checked="" type="checkbox"/>		
Are tools/equipment in good condition/inspected?	<input checked="" type="checkbox"/>		
Is there a planned escape route?	<input checked="" type="checkbox"/>		
Are personnel aware of the location of First Aid supplies?	<input checked="" type="checkbox"/>		
Have the emergency notification procedures been covered with employees?	<input checked="" type="checkbox"/>		
Has Hilcorp EH&S been notified 72 hrs. prior to Confined Space Entry projects?			<input checked="" type="checkbox"/>
Are all personnel trained/ certified to use equipment/ engage in task?	<input checked="" type="checkbox"/>		
Are all personnel donning appropriate PPE?	<input checked="" type="checkbox"/>		
Will this project create a hazard to others in the vicinity?			<input checked="" type="checkbox"/>
Do all personnel understand correct incident/spill reporting?	<input checked="" type="checkbox"/>		

## HILCORP ALASKA, LLC: JOB SAFETY ANALYSIS (JSA)

JOB STEPS (Describe and number each step)	POTENTIAL HAZARDS ASSOCIATED WITH EACH JOB STEP (Identify each hazard with a CAPITAL letter)	CORRECTIVE ACTION(S) (Identify responsible person with initials)
1 Travel to location, retrieval, redeployment of equipment and travel to shore	<p>A Contact with sea ice falls overboard, items moving Heavy seas - slips, trips, falls</p> <p>B Falls overboard, items moving</p> <p>C Heavy winds - slips, trips, falls wind burn, items moving cold temps - frostbite, skin/eye irritation, hypothermia - cold exposure</p> <p>D Dangerous atmosphere - contact with increased LEL %</p>	<p>a Proper handrails, Pilot data news forecast data</p> <p>b Proper handrails, secure items procedure for extreme weather proper PPE on deck, non-slip foot wear, captain discretion</p> <p>c handrails, secure items PPE, captain discretion cold weather procedures PPE, warm clothing Continuous monitoring of three 4-gas meters</p>
2 Rigging of equipment	<p>A Pinch points, crushing &amp; cuts</p>	<p>a Proper rigging procedures PPE for job, identify pinch points and keep personnel alerted, communication, proper equipment &amp; inspected trained to use</p>
3 Lifting of equipment for deployment and retrieval	<p>A Fall, slips, trips</p> <p>B moving and falling of overhead material, overhead lifting crushing or struck-by</p> <p>C mechanical</p>	<p>a Proper housekeeping fall protection / harness use crane for heavy equipment</p> <p>b Proper procedures, no working under items overhead, hard hats, gloves &amp; safety toe shoes inspect equipment &amp; material proper trained personnel</p>
4 Safety Brief for vessel	<p>A Not knowing protocols and location of emergency &amp; survival protocols</p>	<p>A Have Captain provide a in depth vessel safety brief</p>

This JSA should be reviewed by everyone involved with the project. This JSA is not considered complete until everyone involved with the project signs below, along with any other contributing personnel. Should personnel need more space to complete the JSA, or if new hazards are presented due to changing conditions, an additional JSA form should be utilized and attached to these pages. Make notes on how the task can be performed in an even safer manner, and keep JSA's on file so that they may be referenced in the future should a similar project be conducted.

INVOLVED PERSONNEL SIGNATURES:

Environmental Sampler

Environmental Sampler

Environmental Sampler

Environmental Sampler

Environmental Sampler

Environmental Sampler

Safety Professional

## DAILY JOB REPORT

Directions: *Note problems encountered, RFI's, verbal communications with Client's representative, change order work performed.*  
*Note any important events*  
*Send a copy via fax to Nikiski office by 900 am.*

### Work By PEAK:

The work performed by 1 PEAK employee (Safety Professional) was to provide HSE support to the personnel obtaining water samples for the Hilcorp Pipeline Gas Leak. HSE support included: JSA, pre-job safety meeting, permit to work, continuous monitoring of three 4-gas meters and continuous safety support.

**Work by Subcontractors:**

Work performed by 5 subcontractors, was that of multiple water sampling by 3 SLR employees and 2 Aridea employees.

### Safety Topic/Injury's

JSA and permit to work were completed for this job. Copy of JSA/permit to work is attached with this daily job report.

Comments:

Time line of events for this job are attached in a word document to this daily job report.

Supervisor

## Safety Professional

Signature

to

Report No. 2

Peak Job No. 23054 Date 3/24/2017

Job Name HSE support for air water interface  
sampling for Gas Pipeline Leak

[illegible]

The follow is a list of events that took place for the Hilcorp pipeline gas leak air water interface sampling on Friday 3-24-2017:

**1045** – JSA and pre-job safety meeting completed. Vessel safety brief by deck hand

**1100** – Depart Port aboard the Resolution owned and operated by OMSI

**1100** – Weather noted: Sunny skies, wind less than 1 knot, calm seas and temperature at 27\* F. Ice conditions were very favorable.

**1130** – Three 4-gas meters were taped to wooden mop handles and taped to the railings of the vessel. The height of all the gas meters ranged between 5'6" and 6'0". One was placed at the bow, one was placed 30 feet towards the rear on the portside of the vessel and one was placed mid-deck on the starboard side of the vessel. The monitors were turned on at this time.

**1235** – Practice deployment and retrieval of the larger air water interface buoy. The use of ladders, fall protection and a crane for this larger buoy.

**1315** – First sample taken with 0% LEL on gas meters. (air water interface buoy sample)

**1400** – Second sample taken with 0% LEL on gas meters. (air water interface buoy sample)

**1448** – Third sample taken with 0% LEL on gas meters. (air water interface buoy sample)

**1535** – Placed vessel on top of leak (within 10 feet) methane gas bubbles were visible. Lowered air water interface buoy on top of bubbles and held position for 10 minutes. 0% LEL on gas meters throughout sampling on top of leak.

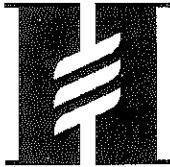
**1637** – Fifth sample taken with 0% LEL on gas meters. (air water interface buoy sample)

**1740** – 4-gas meters turned off and vessel headed back to port.

**1800**– Arrived to port and close out of Permit to Work.

There were no injuries/incidents and safety was a focus for all personnel performing today's tasks. Proper use of safety toe boots, hard hats, gloves and fall protection were noted throughout all tasks. A focus on pinch points, crush-by/contact-by and overhead objects were a focus during rigging and work being performed via crane.

The crew had a good safety catch during today's testing. OSK provided us with ladder that had a broken leg. An extra buoy on the vessel was used to tag the ladder out of commission and information of the broken ladder was relayed to OSK staff when arrival to dock at the end of the day.



## Permit to Work (PTW) / Job Safety Analysis (JSA)

JSA's should be considered prior to any work. JSA's are mandatory for that require the use of Hilcorp Alaska's Permit to Work system.

DATE: 3-24-17 START TIME: 10:45 Am END TIME: 10:45 Pm

FACILITY: N/A LOCATION / AREA: Cook Inlet

PROJECT DESCRIPTION: methane Pipeline Leak  
water/air quality sampling

### CONFINED SPACE ENTRY REQUIREMENTS:

The operations team and work team have evaluated the confined space and agree that none of the following conditions exist and a Confined Space Entry Permit is not required. Operations Lead or Permit Issuer Initials: \_\_\_\_\_

- 1) The space does not contain any type of hazardous atmosphere.
- 2) The space does not have the potential to entrap or engulf an entrant.
- 3) The space does not contain any other serious safety or health hazard.

### Emergency Contact Info

Area controller: Vessel Captain  
Safety: Hilcorp Safety Professional  
Construction Rep: Hilcorp Environmental Specialist  
Emergency Muster Area: Bridge of the vessel

### GENERAL SAFETY CONSIDERATIONS

	Y	N	N/A
Are Standard Operating Procedures available and being followed?	<input checked="" type="checkbox"/>		
Do personnel have proper tools/equipment for the job?	<input checked="" type="checkbox"/>		
Are tools/equipment in good condition/inspected?	<input checked="" type="checkbox"/>		
Is there a planned escape route?	<input checked="" type="checkbox"/>		
Are personnel aware of the location of First Aid supplies?	<input checked="" type="checkbox"/>		
Have the emergency notification procedures been covered with employees?	<input checked="" type="checkbox"/>		
Has Hilcorp EH&S been notified 72 hrs. prior to Confined Space Entry projects?			<input checked="" type="checkbox"/>
Are all personnel trained/ certified to use equipment/ engage in task?	<input checked="" type="checkbox"/>		
Are all personnel donning appropriate PPE?	<input checked="" type="checkbox"/>		
Will this project create a hazard to others in the vicinity?			<input checked="" type="checkbox"/>
Do all personnel understand correct incident/spill reporting?	<input checked="" type="checkbox"/>		

Additional Permits Required: ☐ Hot Work ☐ Confined Space Entry ☐ Isolation of Hazardous Energy ☐ Excavation & Trenching

### HAZARD-CONTROL INDEX (THIS LIST IS NOT EXHAUSTIVE)

<b>SLIPS/TRIPS/FALLS</b> <input checked="" type="checkbox"/> Clean surfaces (housekeeping) <input checked="" type="checkbox"/> Barricade <input checked="" type="checkbox"/> Focus on path <input type="checkbox"/> Use alternate route <input type="checkbox"/> Relocate equipment/project <input type="checkbox"/> Examine scaffolding condition <input type="checkbox"/> Examine handrail condition  <b>FALLS FROM ELEVATION (4'+)</b> <input type="checkbox"/> Move work to ground level <input type="checkbox"/> Ladder inspections <input type="checkbox"/> Proper ladder material/placement <input checked="" type="checkbox"/> Additional PPE (Fall Protection) <u>rails</u>	<b>PINCH POINTS/SHARP OBJECTS</b> <input checked="" type="checkbox"/> Proper guarding <input checked="" type="checkbox"/> Proper body placement  <b>FIRE/EXPLOSION</b> <input type="checkbox"/> Permitting <input checked="" type="checkbox"/> Air testing/monitoring <input type="checkbox"/> Remove combustible/flam materials <input type="checkbox"/> Fire watch <input type="checkbox"/> Fire extinguishers <input checked="" type="checkbox"/> Additional PPE  <b>HIGH NOISE LEVELS</b> <input type="checkbox"/> Relocate work <input type="checkbox"/> Additional PPE (Hearing protection etc.)	<b>ENERGIZED EQUIPMENT</b> <input checked="" type="checkbox"/> Guarding <input checked="" type="checkbox"/> Proper body placement <input checked="" type="checkbox"/> No loose clothing  <b>REPETITIVE MOTION</b> <input type="checkbox"/> Proper technique/tools <input type="checkbox"/> Ask for assistance <input type="checkbox"/> Work/rest schedule  <b>PRESSURE</b> <input type="checkbox"/> Communication <input type="checkbox"/> Barricading <input type="checkbox"/> Shielding <input type="checkbox"/> Proper body placement <input type="checkbox"/> Block & bleed protocol	<b>ELECTRICAL SHOCK</b> <input type="checkbox"/> Testing <input checked="" type="checkbox"/> Grounding <input checked="" type="checkbox"/> Equipment shielding/condition <input type="checkbox"/> GFCI's <input type="checkbox"/> Examine electrical clearances  <b>LIFTING/PULLING/PUSHING</b> <input checked="" type="checkbox"/> Utilize right tools for job <input checked="" type="checkbox"/> Proper technique <input checked="" type="checkbox"/> Smaller/lighter loads <input type="checkbox"/> Examine path <input type="checkbox"/> Use alternate route <input type="checkbox"/> Work rest schedule	<b>LOCK-OUT/TAG-OUT CONDITIONS</b> <input type="checkbox"/> Electrical isolation <input type="checkbox"/> Pressure isolation <input type="checkbox"/> Energized equipment isolation <input type="checkbox"/> Fire/explosion isolation  <b>HAZARDOUS CHEMICALS</b> <input type="checkbox"/> Consult MSDS <input type="checkbox"/> Label/store containers correctly <input type="checkbox"/> Spill prevention considered <input type="checkbox"/> Additional PPE (Goggles etc.)  <b>ATMOSPHERIC</b> <input type="checkbox"/> Respirators <input checked="" type="checkbox"/> Testing/monitoring
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WORK TEAM LEADER (print): Environmental Sampler Signature: Environmental Sampler  
PERMIT APPROVER (print): Safety Professional Signature: Safety Professional  
AREA CONTROLLER (print): Vessel Captain Signature: Vessel Captain  
Revalidation or Extension Time (4 Hour Max):  
Permit Approver (print): \_\_\_\_\_ Time: \_\_\_\_\_  
Signature: \_\_\_\_\_  
Close Out Signature: Environmental Sampler  
Work Team Leader: Vessel Captain Time: 6:00 Pm  
Area Controller: Vessel Captain Time: 6:00 Pm

## HILCORP ALASKA, LLC: JOB SAFETY ANALYSIS (JSA)

JOB STEPS (Describe and number each step)	POTENTIAL HAZARDS ASSOCIATED WITH EACH JOB STEP (Identify each hazard with a CAPITAL letter)	CORRECTIVE ACTION(S) (Identify responsible person with initials)
1 Travel to Location, retrieval and redeployment of equip, travel to dock	<p>A contact with sea ice falls overboard, items moving Heavy seas- slips, trips, falls</p> <p>B Falls overboard, items moving</p> <p>C Heavy winds- slips, trips, falls wind burn, items moving cold temps. frostbite, skin/eye</p> <p>D Irritation, hypothermia, cold exposure</p> <p>E Dangerous atmosphere - Contact w/increased LEL%</p>	<p>a Proper handrails, pilot data NWG forecast data</p> <p>b Handrails, secure items Procedure for extreme weather PPE on deck, non-slip foot wear, captain discretion</p> <p>c Hand rails, secure items PPE, captain discretion cold weather procedures</p> <p>d PPE, warm clothing Continuous monitoring of three 4-gas meters</p>
2 Rigging of Equipment	A Pinch points, crushing & cuts	<p>a Rigging procedures, PPE, identify Pinch points, Personnel alerted Communication, proper equip &amp; inspect, trained to use</p>
3 Lifting of equipment for deployment & retrieval	<p>A Fall, slips, trips moving &amp; falling overhead material</p> <p>B overhead lifting crushing or struck by</p> <p>C mechanical</p>	<p>a Housekeeping, fall protection de-iced deck use crane for heavy equip procedures, no working under crane, hard hats, gloves, safety toe boots, communication inspect equip &amp; material trained to use</p>
4 Safety brief of vessel	A not knowing protocols & location of emergency & survival protocol	a Deckhand provide a in depth vessel safety brief

This JSA should be reviewed by everyone involved with the project. This JSA is not considered complete until everyone involved with the project signs below, along with any other contributing personnel. Should personnel need more space to complete the JSA, or if new hazards are presented due to changing conditions, an additional JSA form should be utilized and attached to these pages. Make notes on how the task can be performed in an even safer manner, and keep JSA's on file so that they may be referenced in the future should a similar project be conducted.

INVOLVED PERSONNEL SIGNATURES:

Environmental Sampler

Environmental Sampler

Environmental Sampler

Environmental Sampler

Environmental Sampler

Safety Professional



**ATTACHMENT C**  
**ACOUSTIC MONITORING SUMMARY REPORT**

March 29, 2017

## TRIP REPORT #1

**FROM** Acoustician Professional  
**TO:** Hilcorp Environmental Specialist

**SUBJECT:** Brief trip report from acoustic monitoring in Cook Inlet on March 26

On Friday March 24<sup>th</sup> 2017 a field scientist from JASCO Applied Sciences (JASCO) traveled to Kenai, AK to provide acoustic monitoring services for Hilcorp Alaska LLC (Hilcorp) at their Middle Ground Shoal pipeline leak site. On Saturday March 25<sup>th</sup> the JASCO team traveled from Kenai to OSK Dock in Nikiski and began equipment preparations for acoustic monitoring the next day (preparations included mooring assembly, testing and calibration). On Sunday March 26<sup>th</sup> at 07:00AKDT monitoring teams from JASCO and ARIda (the air and water quality sampling team) arrived at OSK dock to load equipment and begin daily HSE meetings and JSAs. At 08:00AKDT both teams boarded OMSI's *Resolution* to travel to the site of the leak and begin monitoring. The *Resolution* was on site at 09:08AKDT to begin the first acoustic sampling drift. Ice conditions in the area were forecasted by NOAA to be 4-6 tenths and there were ice pans around the vessel. JASCO deployed an Autonomous Multichannel Acoustic Recorder (AMAR) to collect acoustic recordings. The AMAR was suspended beneath a surface float, with the hydrophone at a depth of 15m below the surface. A satellite beacon on the surface float allowed tracking of the AMAR's position through time. The AMAR drifted SW within ~20m (66 ft) of the leak site, and was recovered after a 30-minute drift. JASCO deployed the AMAR a second time at 10:20AKDT and the AMAR drifted within ~90m (0.06 mi) of the leak site, the mooring drifted SW for roughly 32 minutes. At 12:13AKDT the JASCO AMAR was deployed a third time, roughly 2.4 km (1.5 miles) from the leak site, to collect ambient sound measurements for 40 minutes. The AMAR was deployed a fourth time at 13:16AKDT, close to slack tide, very close to the leak site. The AMAR was left to drift and the *Resolution* motored 1.5 miles away to avoid contamination of the noise monitoring by ship noise. Between 13:35 and 13:40 the GPS satellite beacon on the AMAR was submerged beneath ice and stopped broadcasting. The *Resolution* crew began a search based on last known position and tides and current predictions. The search lasted until 19:30AKDT but was unsuccessful. At 20:00AKDT the *Resolution* returned to OSK Dock and unloaded. The JASCO team continued to monitor for signals from the GPS beacon through the night. The satellite beacon resumed transmissions at 03:25AKDT Monday March 27<sup>th</sup> and the *Resolution* crew was mobilized to retrieve the AMAR. The system was recovered at 08:15AKDT and arrived at OSK dock at 16:45AKDT, at which time the JASCO team calibrated the AMAR and downloaded the data.

Acoustic monitoring will be repeated once ice conditions have cleared to 1 tenth or less; expected to be in the first or second week of April. JASCO will prepare a summary report of the recorded sound levels from both acoustic monitoring trips.

## **ADDITIONAL SAFETY DOCUMENTATION**

# DAILY JOB REPORT

Directions: *Note problems encountered, RFI's, verbal communications with Client's representative, change order work performed.*  
*Note any important events*  
*Send a copy via fax to Nikiski office by 900 am.*

## Work By PEAK:

The work performed by 1 PEAK employee ( Safety Professional ) was to provide HSE support to the personnel obtaining water samples for the Hilcorp Pipeline Gas Leak. HSE support included: JSA, pre-job safety meeting, permit to work, continuous monitoring of three 4-gas meters and continuous safety support.

**Work by Subcontractors:**

Work performed by 3 subcontractors, was that of acoustic water sampling by 1 JASCO employee and air water interface by 2 Aridea employees.

Safety Topic/Injury's	Frequency	Severity	Control Measures
Slips, Trips and Falls	High	High	Wear slip-resistant shoes, keep work area clean and free of clutter, use proper walking technique.
Struck by Moving Equipment	Medium	High	Establish clear communication with equipment operators, use proper hand signals, maintain safe distances.
Electrocution	Low	High	Use proper lockout/tagout procedures, wear insulated gloves and tools, avoid contact with live wires.
Heavy Lifting	Medium	Medium	Use proper lifting technique, use mechanical aids (dollies, hoists), avoid twisting or bending.
Confined Space Entry	Low	High	Obtain proper permits, use ventilation, wear gas monitoring equipment, have a rescue plan.
Excavation and Trenching	Medium	High	Shoring and shoring, use trench shields, ensure proper trench depth and width.
Weather-Related Incidents	Low	Medium	Monitor weather forecasts, use proper clothing and equipment, avoid working in adverse conditions.
Vehicle Accidents	Medium	Medium	Obey traffic laws, wear seatbelts, avoid distractions while driving.
Fire and Explosion	Low	High	Use proper fire safety protocols, keep fire extinguishers accessible, avoid open flames.
Chemical Hazards	Low	High	Wear proper PPE, use proper handling techniques, avoid contact with skin and eyes.
Biological Hazards	Low	Medium	Wear proper PPE, use proper disposal methods, avoid contact with bodily fluids.
Radioactive Hazards	Low	High	Wear proper PPE, use proper handling techniques, avoid contact with radioactive materials.
Asbestos Exposure	Low	High	Wear proper PPE, use proper handling techniques, avoid disturbing asbestos-containing materials.
Lead Exposure	Low	High	Wear proper PPE, use proper handling techniques, avoid contact with lead-containing materials.
Carbon Monoxide Exposure	Low	High	Use proper ventilation, avoid using generators in enclosed spaces, install carbon monoxide detectors.
Heat Stress	Medium	Medium	Wear proper clothing, use proper hydration techniques, take breaks in shaded areas.
Cold Stress	Medium	Medium	Wear proper clothing, use proper hydration techniques, take breaks in warm areas.
Altitude Sickness	Low	Medium	Acclimatize properly, use proper hydration techniques, avoid strenuous activity.
Jet Lag	Low	Medium	Adjust sleep schedule, use proper hydration techniques, avoid alcohol and caffeine.
Travel Fatigue	Low	Medium	Take breaks, use proper hydration techniques, avoid driving for long periods.
Language Barriers	Low	Medium	Use proper communication techniques, use interpreters, avoid misunderstandings.
Cultural Differences	Low	Medium	Respect cultural differences, use proper communication techniques, avoid stereotypes.
Religious Observances	Low	Medium	Respect religious observances, use proper communication techniques, avoid discrimination.
Sexual Harassment	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Stress	Medium	Medium	Use proper stress management techniques, take breaks, avoid overwork.
Substance Abuse	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Mental Health Issues	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Physical Health Issues	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Disability	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Age Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Gender Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Race Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Ethnicity Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Religion Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Sexual Orientation Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Marital Status Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
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Marital Status Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Parental Status Discrimination	Low	High	Establish clear policies, use proper communication techniques, avoid discrimination.
Disability Discrim			

JSA and permit to work were completed for this job. Copy of JSA/permit to work is attached with this daily job report. Talked about ladder safety and checking equipment prior to use.

Comments:

Time line of events for this job are attached in a word document to this daily job report.

Supervisor \_\_\_\_\_ Safety Professional \_\_\_\_\_  
Signature \_\_\_\_\_

to

Report No. 3

Peak Job No. 23054 Date 3/26/2017

Job Name HSE support for air water interface  
sampling and acoustic testing for Gas  
Pipeline Leak

[illegible]

The follow is a list of events that took place for the Hilcorp pipeline gas leak air water interface sampling and acoustic testing on Sunday 3-26-2017:

**0700** – JSA and pre-job safety meeting completed

**0800** – Vessel safety orientation provided by deck hand

**0810** – Depart Port aboard the Resolution owned and operated by OMSI

**0810** – Weather noted: Sunny skies, wind at 5 knots, calm seas and temperature at 12\* F. Ice conditions were less than favorable.

**0830** – Three 4-gas meters were taped to wooden mop handles and taped to the railings of the vessel. The height of all the gas meters ranged between 5'6" and 6'0". One was placed at the bow, one was placed 30 feet towards the rear on the portside of the vessel and one was placed mid-deck on the starboard side of the vessel. The monitors were turned on at this time.

**0910** – First acoustic sample taken with 0% LEL on gas meters. (buoy float)

**1041** – Second acoustic sample and first air water interface sample taken with 0% LEL on gas meters. (air water interface buoy sample)

**1215** – Ambient acoustic sample taken at 2 miles from leak. (buoy float)

**1218-1220** – There will be a noted spike in the % LEL on one of the 4-gas meters. This was due to the sampling crew testing their methane gas canister. The crew held the hose of the canister over the monitor to see if the 4-gas meter would pick up a reading. They used this information for calibration of their equipment.

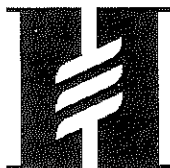
**1317**– Third acoustic sample taken with 0% LEL on gas meters. (buoy float)

**1400 - 1930** – Acoustic buoy was lost and searched for over this period of time. Buoy was never located.

**1430** – 4-gas meters were turned off during search of buoy as we were 16 miles away from leak.

**1940**– Arrived to port and close out of Permit to Work.

There were no injuries/incidents and safety was a focus for all personnel performing today's tasks. Proper use of safety toe boots, hard hats, gloves and fall protection were noted throughout all tasks. A focus on pinch points, crush-by/contact-by and overhead objects were a focus during rigging and work being performed via crane.



# Permit to Work (PTW) / Job Safety Analysis (JSA)

JSA's should be considered prior to any work. JSA's are mandatory for that require the use of Hilcorp Alaska's Permit to Work system.

DATE: 3-26-17 START TIME: 0700 END TIME: 1900

FACILITY: N/A LOCATION / AREA: Look Inlet

PROJECT DESCRIPTION: methane pipeline leak acoustic sampling

## CONFINED SPACE ENTRY REQUIREMENTS:

The operations team and work team have evaluated the confined space and agree that none of the following conditions exist and a Confined Space Entry Permit is not required. Operations Lead or Permit Issuer Initials: \_\_\_\_\_

- 1) The space does not contain any type of hazardous atmosphere.
- 2) The space does not have the potential to entrap or engulf an entrant.
- 3) The space does not contain any other serious safety or health hazard.

Additional Permits Required: ☐ Hot Work ☐ Confined Space Entry ☐ Isolation of Hazardous Energy ☐ Excavation & Trenching

## HAZARD-CONTROL INDEX (THIS LIST IS NOT EXHAUSTIVE)

### SLIPS/TRIPS/FALLS

- ☒ Clean surfaces (housekeeping)
- ☒ Barricade
- ☒ Focus on path
- ☐ Use alternate route
- ☐ Relocate equipment/project
- ☐ Examine scaffolding condition
- ☐ Examine handrail condition

### FALLS FROM ELEVATION (4'+)

- ☐ Move work to ground level
- ☐ Ladder inspections
- ☐ Proper ladder material/placement
- ☒ Additional PPE (Fall Protection)

rails

### PINCH-POINTS/SHARP OBJECTS

- ☒ Proper guarding
- ☒ Proper body placement

### FIRE/EXPLOSION

- ☐ Permitting
- ☒ Air testing/monitoring
- ☐ Remove combustible/flam materials
- ☐ Fire watch
- ☐ Fire extinguishers
- ☒ Additional PPE

### HIGH NOISE LEVELS

- ☐ Relocate work
- ☐ Additional PPE (Hearing protection etc.)

### ENERGIZED EQUIPMENT

- ☒ Guarding
- ☒ Proper body placement
- ☒ No loose clothing

### REPETITIVE MOTION

- ☐ Proper technique/tools
- ☐ Ask for assistance
- ☐ Work/rest schedule

### PRESSURE

- ☐ Communication
- ☐ Barricading
- ☐ Shielding
- ☐ Proper body placement
- ☐ Block & bleed protocol

### ELECTRICAL SHOCK

- ☐ Testing
- ☒ Grounding
- ☒ Equipment shielding/condition
- ☐ GFCI's
- ☐ Examine electrical clearances

### LIFTING/PULLING/PUSHING

- ☒ Utilize right tools for job
- ☒ Proper technique
- ☒ Smaller/lighter loads
- ☐ Examine path
- ☐ Use alternate route
- ☐ Work rest schedule

### LOCK-OUT/TAG-OUT CONDITIONS

- ☐ Electrical isolation
- ☐ Pressure isolation
- ☐ Energized equipment isolation
- ☐ Fire/explosion isolation

### HAZARDOUS CHEMICALS

- ☐ Consult MSDS
- ☐ Label/store containers correctly
- ☐ Spill prevention considered
- ☐ Additional PPE (Goggles etc.)

### ATMOSPHERIC

- ☐ Respirators
- ☒ Testing/monitoring

## Emergency Contact Info

Area controller: Vessel Captain

Safety: Hilcorp Safety Professional

Environmental Construction Rep: Hilcorp Environmental Specialist

Emergency Muster Area: Bridge/deck of vessel

## GENERAL SAFETY CONSIDERATIONS

	Y	N	N/A
Are Standard Operating Procedures available and being followed?	<input checked="" type="checkbox"/>		
Do personnel have proper tools/equipment for the job?	<input checked="" type="checkbox"/>		
Are tools/equipment in good condition/inspected?	<input checked="" type="checkbox"/>		
Is there a planned escape route?	<input checked="" type="checkbox"/>		
Are personnel aware of the location of First Aid supplies?	<input checked="" type="checkbox"/>		
Have the emergency notification procedures been covered with employees?	<input checked="" type="checkbox"/>		
Has Hilcorp EH&S been notified 72 hrs. prior to Confined Space Entry projects?			<input checked="" type="checkbox"/>
Are all personnel trained/ certified to use equipment/ engage in task?	<input checked="" type="checkbox"/>		
Are all personnel donning appropriate PPE?	<input checked="" type="checkbox"/>		
Will this project create a hazard to others in the vicinity?			<input checked="" type="checkbox"/>
Do all personnel understand correct incident/spill reporting?	<input checked="" type="checkbox"/>		

WORK TEAM LEADER (print): Acoustician Professional Signature: Acoustician Professional

PERMIT APPROVER (print): Safety Professional Signature: Safety Professional

AREA CONTROLLER (print): Vessel Captain Signature: Vessel Captain

Revalidation or Extension Time (4 Hour Max):

Permit Approver (print): Safety Professional Time: 2030

Signature: Safety Professional

Close Out Signature: Environmental Sampler

Work Team Leader: Environmental Sampler Time: 7:40 PM

Area Controller: Vessel Captain Time: 7:40 PM



## HILCORP ALASKA, LLC: JOB SAFETY ANALYSIS (JSA)

JOB STEPS (Describe and number each step)	POTENTIAL HAZARDS ASSOCIATED WITH EACH JOB STEP (Identify each hazard with a CAPITAL letter)	CORRECTIVE ACTION(S) (Identify responsible person with initials)
1 Travel to location, retrieval & redeployment of equipment travel to dock	<p>A contact with sea ice falls, items moving Heavy seas - slips, trips, falls falls overboard, items moving</p> <p>B</p> <p>C Heavy winds - slip, trips, falls wind burn, items moving cold temps, frostbite, skin/eye irritation, hypothermia, cold exposure</p> <p>D Dangerous atmosphere - contact w/increased LEL/O<sub>2</sub></p> <p>E</p>	<p>a Proper handrails, pilot data news forecast data</p> <p>b handrails, secure items Procedure for extreme weather PPE on deck, non-slip foot wear, captain discretion</p> <p>c PPE, captain discretion cold weather procedures PPE, warm clothing</p> <p>d</p> <p>e continuous monitoring of three - 4 gas meters</p>
2 Rigging of Equipment	<p>A Pinch points, crushing &amp; cuts</p>	<p>a rigging procedures, ppe, identify pinch points, personnel alerted communication, proper equip and inspect, trained to use</p>
3 Lifting of equipment for deployment and redeployment	<p>A Fall, slips, trips moving and falling overhead material, crushing or struck-by</p> <p>B</p> <p>C mechanical</p>	<p>a housekeeping, fall PPE device deck, life rest use crane for heavy equip procedures, no working under, hard hats, safety toe, communication</p> <p>b inspect equip &amp; material trained to use</p> <p>c</p>
4 safety brief of vessel	<p>A not knowing protocols &amp; location of emergency &amp; survival protocol</p>	<p>a deckhand provide a in- depth vessel safety brief</p>

This JSA should be reviewed by everyone involved with the project. This JSA is not considered complete until everyone involved with the project signs below, along with any other contributing personnel. Should personnel need more space to complete the JSA, or if new hazards are presented due to changing conditions, an additional JSA form should be utilized and attached to these pages. Make notes on how the task can be performed in an even safer manner, and keep JSA's on file so that they may be referenced in the future should a similar project be conducted.

INVOLVED PERSONNEL SIGNATURES:

Environmental Sampler

Environmental Sampler

Acoustician Professional